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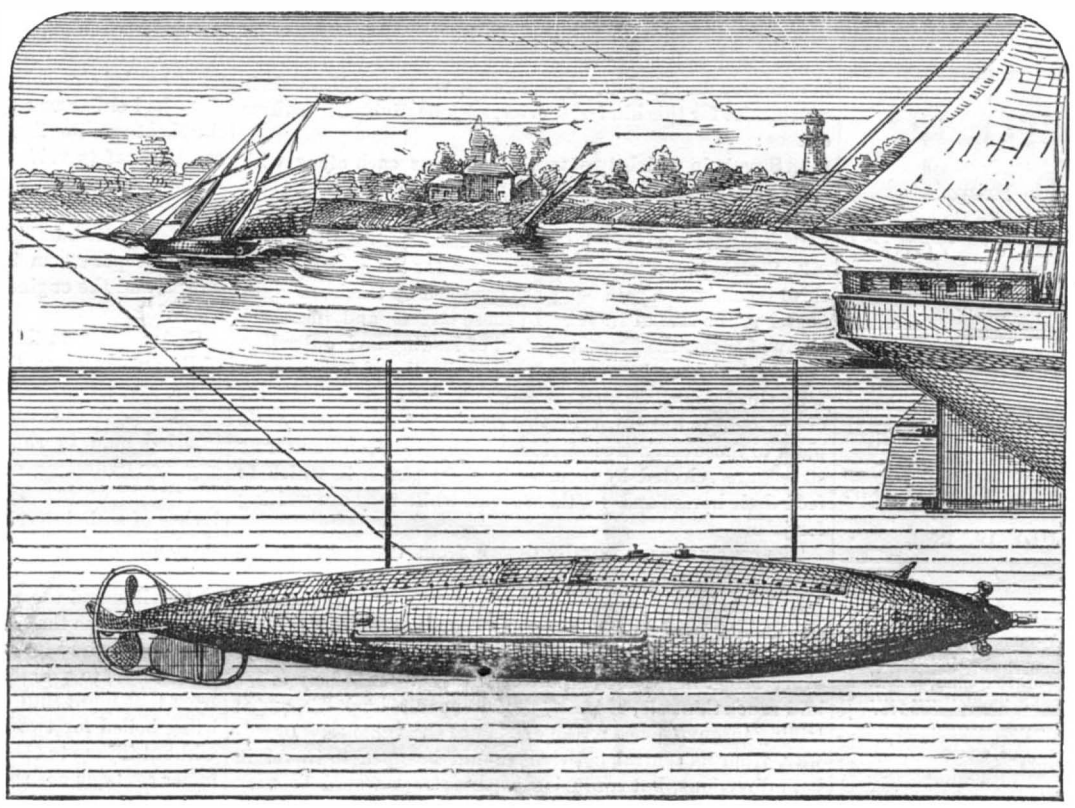
RECENT IMPROVEMENTS IN TORPEDO WARFARE.

While foreign nations are lavishing millions upon the experimental construction of vessels, the iron decks of which will resist the fiercest bombardment, our own government is quietly testing and examining a mode of naval warfare to which the most herculean ironclad is as vulnerable as the weakest wooden ship. The submarine torpedo, as a means of defence, is already well known, and it is now but a simple matter to render a harbor impassable to hostile vessels; but while entrance to a land locked or narrow mouthed port is thus prevented, there is nothing to hinder a ship of war, lying without the roads and at a distance of several miles away, if she be armed with modern long range guns, from throwing their projectiles over all obstructions into the heart of a city or town. It is to supply this need that inventors have lately sought to combine the torpedo with a suitably constructed and submerged sea-going vessel which might be maneuvered and governed in the ordinary way, and propelled by steam or other power into the midst of an enemy's fleet, where, unseen and hence impregnable, she might proceed to sink and destroy ship after ship.

Our engravings represent two of the most formidable as well as the most recent applications of this terrible engine of war.

The first is a sketch of the Lay torpedo, which, our readers will remember, we have already alluded to as being under examination at the naval station at Newport, R. I. The hull of the craft is about thirty feet long and three feet wide, cigar shaped, and formed of water and air tight iron plates. It is divided into three compartments; one for motive power, another for machinery, and the third for electrical apparatus. The motive power consists in carbonic acid gas, compressed, in sufficient quantity to drive a pair of oscillating engines of eight horse power, and thus operate a screw for the period of half an hour, during which time the boat is designed to travel some six or eight miles. The machinery is controlled by wires leading to a battery on shore, the opening or closing of the first circuit governing the throttle, and the same on the second wire actuating the steering gear. The cable containing the wire is paid out as the boat moves, and of course there is no crew on board. The vessel is almost entirely submerged; and being painted green; is undistinguishable at short distances to the unaided eye. In the magazine are placed 500 lbs. of powder or nitroglycerin; and in the forward portion of the vessel, explosive shells are also arranged to be fired by an electric spark passing through a third wire in the cable. The explosion of the shells may be effected without injury to the boat, but that of the magazine necessarily causes her destruction.

The illustration annexed, which we extract from the SCIENCE RECORD for 1873, affords a clear idea of the general form of the vessel and her position in attacking an enemy's ship. Experiments made at Newport, some time since, proved quite successful; but of late we note that, from various causes, such promising results have not been attained. The invention was patented by Mr. John L. Lay, on the 25th of March, 1872; but as early as 1866 he had conceived the idea, and made drawings of its working portions. In 1870, at the request of the Viceroy of Egypt, a boat was constructed from these plans and sent to that country for trial by the Egyptian Government. The examinations proving satisfactory, the inventor received payment for his design, and shortly afterwards, returning to the United States, opened the negotiations with our Government, of which the present investigations form a part. The invention has recently been made the subject of an interference suit by John A. Ballard, of Bombay, India, who claimed to have patented the device in this country as early as 1870, but the decision of the Patent Office has accorded priority to Mr. Lay.

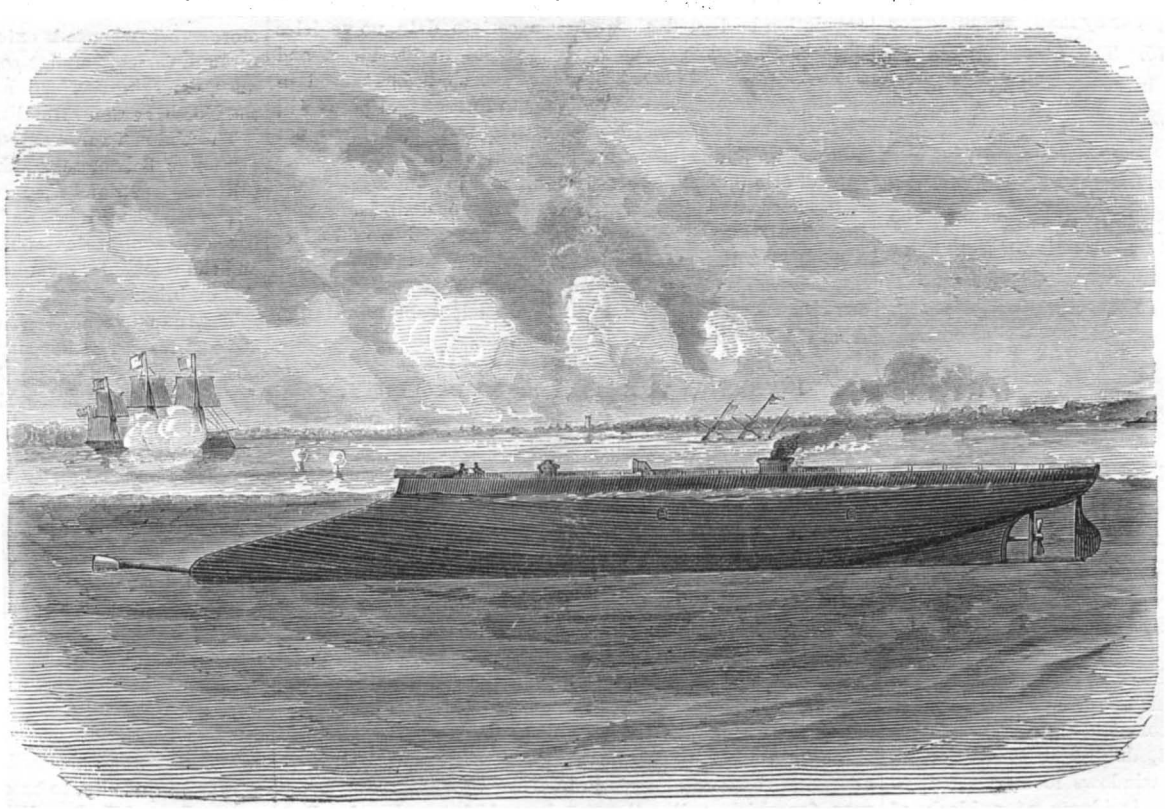


THE LAY TORPEDO.

A vessel which, although not yet launched, has already attained a world-wide fame, is Admiral Porter's torpedo boat, the subject of our second engraving. The sketch, taken from the ship as she lies unfinished on the stocks at the Brooklyn navy yard, does not necessarily aim to present the details of construction with accuracy, but serves to convey a good idea of the general configuration and shape of the vessel. She is 174 feet long, 28 feet broad, and 13 deep, and is built of thoroughly tested charcoal iron. The sheathing of the hull is from three eighths to half an inch thick, and in some portions this is increased. As we explained, in a recent article on "Iron Ship Construction," this boat is built after what is known as the English "bracket plate system," that is, two vessels may be said to be constructed, one within the other and of equal strength. Within the outside shell three longitudinals of immense strength run the entire length of the vessel and are connected with bars running in a horizontal direction by brackets. The whole is then covered with an iron plating, forming a distinct and perfectly air-tight bottom and sides. The different sections can be used and entered by manholes, which enable a person to pass between the inner and outer vessel from stem to stern, so as to effect repairs in case of injury. The compartments are all watertight, so that in event of grounding or other damage, only a small part of the vessel will fill. The decks are of fine plated steel, and of about half an inch in thickness. The new Fowler propeller wheel will be employed, the pitch of the blades of which can be altered as required, being worked on the eccentric plan; steering and propelling will thus be done by the same means, the rudder being merely auxiliary. The engines, now in process of construction at Roach's iron works in this city, are of the compound type, built in the most careful manner, and it is expected that the boat will be able to steam both astern and ahead at a very high rate of speed. Electric apparatus connects with the engine room and pilot house, from either of which points the vessel can be steered.

In the engraving, the boat is shown in fighting trim. That is, her compartments are filled with water, so that she is entirely submerged with the exception of some three feet. Her three masts are lowered out of the way, and nothing is visible on her deck except her smoke stack, low pilot house, and the heavy gun which she is to carry on her forecastle.

Although built with a "snout," ramming is only a secondary means of attack. In fact her bow is not a solid piece, but is built out some twenty feet in order to allow the torpedoes to be thrust forward well in advance of the boat. An opening, at a slight upward angle, extends clear through the stern, and through this the shell, placed on the end of a staff twenty feet long, is shoved. Of course, after the explosion, a ram given at full speed, accompanied by a shell from the heavy gun, would leave little probability of the attacked vessel remaining on the surface for a very protracted period. The two apertures or ports, shown on the broadside, one amidships and the other near the stern, also serve to push torpedoes from, and are used when the boat is obliged to range alongside a ship instead of meeting her bows-on.



THE PORTER TORPEDO.

It is expected that the vessel will be launched during the present month, and work is being pushed forward upon her as rapidly as possible. When completed, there is little question but that she will be the most destructive marine machine ever constructed in this country.

THE ERICSSON PNEUMATIC TORPEDO

A third novel form of torpedo has been devised by Captain John Ericsson, of Monitor fame, who has lately built an experimental example thereof. The following description is given in the *Army and Navy Journal:*

The intention is to conduct the trials at Vermland, on Long Island Sound. This estate, belonging to C. H. Delamater, Esq., has fully two miles of coast line on the west side of Long Island, thus offering admirable opportunities for testing the "aggressive" instrument. The hull of

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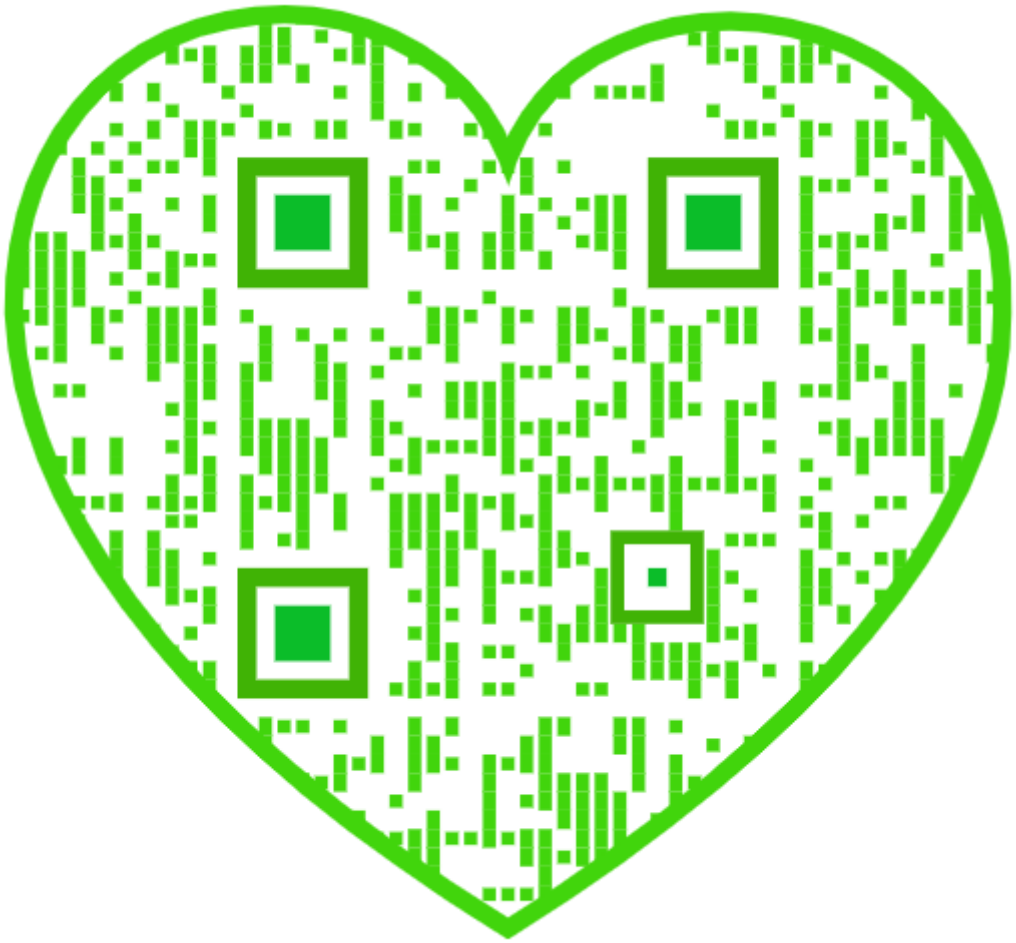

the torpedo vessel, composed of steel plates, is quite small, being eleven feet long, thirty-two inches deep, and twenty inches broad. The midship section is rectangular, while the top and bottom of the hull are planes perfectly parallel. The sides are vertical from stem to stern, the water lines being moderately sharp at both ends. The displacement is greater than might be supposed, considering the small dimensions of the hull, 2,000 pounds being scarcely sufficient to balance the weight of the whole apparatus. The propellers are of the two bladed type, three feet two inches in diameter, with a pitch of five feet. Both propellers revolve round a common center, yet in opposite directions. The constructor put the hidden machinery in motion in our presence; the compressed air being admitted through a tubular cable attached to the stern of the torpedo, the propellers were instantly put in motion, revolving in a contrary direction with a velocity far too great to admit of the number of turns being counted.

The fact has never been published that Captain Ericsson submitted plans to the Emperor Napoleon, in 1854, of an armored, nearly submerged torpedo boat, propelled by steam, intended to run close to an enemy's ship and, by pneumatic power, project a cylindrical vessel containing explosive substances against the hull at a considerable depth below water line. This plan of projecting the charge Captain Ericsson has now applied to his submarine torpedo.

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PUBLISHERS' NOTICE.

All new subscriptions, or renewals of old ones, will be commenced with the new volume, July 5, unless a request to commence at some other date accompanies the order.

The volume from January to July, consisting of twenty-six numbers, may be had in sheets, by mail, at the regular subscription price, namely, $1.50, or in substantial binding, at the office of publication, for $3, or by mail, including postage within the States, for $3.75. The first volume of the SCIENTIFIC AMERICAN for 1873, in sheets, and a copy of the SCIENCE RECORD, for either 1872 or 1873, will be mailed on receipt of $3, or a volume of the SCIENCE RECORD for each year and the last or coming six months of the SCIENTIFIC AMERICAN (optional to the subscriber) will be sent for $4.50.

Bound volumes of the SCIENTIFIC AMERICAN from January to July, 1873, and the SCIENCE RECORD, either for 1872 or 1873, will be forwarded by mail or express, free, for $5. Copies of the SCIENCE RECORD for 1872 and 1873, and the first volume of the SCIENTIFIC AMERICAN for 1873, bound, will be sent for $6.50, or delivered at the publication office for $6.

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STREET TRAVEL.

The following is an extract from the new charter of the city of New York, which shall be the text for a few timely remarks:

"The Common Council shall have power to regulate the use of the streets, highways, roads and public places by foot passengers, vehicles, cars and locomotives."

It has been an amusing sight, doubtless, to many who have been comfortably seated at windows looking out upon Broadway, to notice the various incidents of a block of vehicles in that great thoroughfare. But the matter, practically considered, is not one for amusement, and begins to lose much of its humor when the lookers-on venture out, and essay to cross the street. The mode of formation of one of these jams is at once interesting and instructive. The wheels of two vehicles interlock, it may be, or a balky horse causes a temporary stoppage, when, at once, all the vehicles of the line press forward from up and down the street, and pour in from the cross streets, making confusion worse confounded. This seems to be the average driver's chief aim, to press into the thickest of the jam and then engage in a wordy war.

Travelers who wish to reach the ferries over the North River have experiences from which they would gladly be delivered. A jam exists, we will suppose (and it is readily supposable), on one of the longitudinal streets, and a close line of horses and vehicles is to be seen, unbroken at the crossing. As the head of the line advances a foot or so, all the followers do the same, each horse's nose being kept well up to the vehicle in front; and the impatient traveler, if he will cross, crawls under horses, through mud and mire that are appalling, at certain seasons.

This sort of thing has long ceased to be a joke, and there is plenty of room for regulation of the travel if good can come of it. Let us first examine the present system, or want of system. The principal business of a down town street, considered with reference to its vehicles, consists in loading and unloading trucks, and conveying merchandise in other trucks along it. The streets, with regard to their capabilities for this kind of service, may be divided into three classes:

1. Streets in which two trucks can pass each other with trucks on either side backed up against each curb.

2. Streets through which only one truck can pass, when both sides are occupied by trucks backed against the curbs.

3. Streets in which there is no room for the passage of a third truck, when both sides are occupied by trucks at right angles to the line of travel. In these streets, and there are many of them, the present system of loading and unloading is to back the trucks over each sidewalk, thus leaving space for a third vehicle to go between. By some strange process of reasoning, unknown to the ordinary mortal but quite plain to those eccentric individuals, the drivers, these narrow streets are selected by them as the best places in which to feed their horses and let them stand while they are waiting for jobs.

The conclusions naturally drawn from these statements will be:

I. That there are many streets in which the travel of vehicles should be permitted to take place only in one direction. Excepting Broadway, this regulation would apply to nearly every street in the lower part of the city. It is easy to see how much this rule, of itself, would expedite business, and at trifling inconvenience to the drivers of the vehicles. Broadway, from its central position, should be open to travel in both directions, but confusion in this street would be very much lessened by arranging one side for vehicles going up, and the other for those moving in an opposite direction. A division in the center, composed of short panels of low railing and equal open spaces, alternately, would keep vehicles going in either direction to their proper sides.

II. That there are many streets in which trucks should not be permitted to take positions at right angles to the street for the purposes of loading and unloading, and that in no street should these operations be carried on so as to obstruct the sidewalks. There are several ways in which loading and unloading could be readily effected without encroaching upon the streets or sidewalks: by having courts in warehouses into which the vehicles could be driven; by excavations under the sidewalks opening upon the streets and leading to vaults below, through which goods could be drawn and delivered; or by using cranes and hoists projecting from upper stories of the warehouses. Other means will probably occur to the reader, but those who would be affected by the change might well be trusted to find out the means. Only let the regulation be issued that, after a certain date, no vehicles shall be allowed to stand at right angles to the street and that no obstructions to the sidewalk shall be caused in loading or unloading, and it is easy to foresee that plans will be devised so that the business of the merchants shall not suffer. So radical a change demands, of course, the most careful arrangement of details, and nothing but a mere outline is here attempted. It scarcely admits of doubt, however, that regulations of this nature, rigidly enforced, would effect a change, in the crowded and impassable condition of our down town streets, that would excite the admiration of all our citizens and might, in time, even elicit feeble admiration from the drivers.

INVENTION THE MOTHER OF NECESSITY.

We have always labored under the impression that the only individuals who ever reversed the old saw: "Necessity is the mother of invention," and made it read "Invention is the mother of necessity" were those infatuated geniuses who too often squander their worldly goods in fruitless efforts to carry out impracticable schemes. We have been mistaken, for we have encountered one of those instances in which the inventor, after having worked out his machine, to his satisfaction, in his brain, discovered himself placed by his invention in dire necessity for material for its physical embodiment. He was not a landsman, afflicted with chronic impecuniosity, but a sailor, and an officer of a cruising whaler. His device, which, by the way, is quite an ingenious machine for cutting up blubber as it comes from the animal, necessitated the employment of many cog wheels and other gear, for which, ordinarily, metal would be employed. But at sea one cannot carry a foundery, and besides, no iron or steel was to be had; and even if it were, no tools were probably at hand to get it in shape. Finally, after sundry trials, the huge bones of the whale were thought of, and from these, harder and stronger than ivory, by the aid of a common lathe and a few chisels, a number of cog and bevel wheels, rods, etc., were made, which, for accuracy and neatness of execution, will compare favorably with the work of many professional model makers.

The model, thus ingeniously constructed, was brought to this office a few days since, and letters patent applied for on the device. It affords fresh evidence of that persevering energy which is inherent to all inventors, and, besides, proves that a mind capable of conceiving a useful and valuable idea is never at a loss to devise means, even from the most slender and least promising of resources, for carrying the same into execution.

BOILERS AND BOILER OWNERS.

At about 9 o'clock on the morning of June 22, a boiler, at the Old Duncan Salt Works, Bay City, Mich., exploded with great violence, injuring two men, it is supposed fatally. The part of the boiler which gave way, says our informant, was the crown sheet, over the fire box, which collapsed from pressure, and the whole front of the fire box, with the fire grates, was blown out. The boiler was of the locomotive pattern, and was almost worn out from long use. A gentleman who lives in that vicinity told us that the rivets which originally headed the bolts which held the crown sheet in its place had either rusted or burned off, and that all that held the sheet was the thread in the plate. Added to this were a corroded safety valve and the absence of anything in the shape of a gage. That there was plenty of water in the boiler there is, probably, no doubt, and the accident is undoubtedly attributable to the age of the boiler and the lack of the proper steam indicator. The building is a complete wreck, and the engine and boiler are in a sadly demoralized condition.

Commenting on this, a valued correspondent, Mr. J. E. E., of Pa., who was on the spot immediately after the occurrence, says:

"There is an invention wanted; it is a salamander and ironclad man to run old and worn steam boilers without gages or indicators, of which the safety valves and pumps are out of order. The boilers have from one half to two inches of scale internally, and a similar thickness of mud in the bottom of the boiler. All the stay rods are rusted or eaten off. The iron armor of the man must be so constructed as to withstand the weight of an ordinary steam boiler or two, as well as that of the falling *débris* of a mill; it will also be required to stand the test of being blown (with the man inside) to a hight of 100 feet in the air and the fall from that hight into the ruins of an old mill, and then of being boiled for two hours in water or steam, and all this without injury to the occupant, as it often is the case that the boiler contains hot water and steam when it goes off. Such an invention would find ready sale among the owners of old oil and salt wells, where hundreds of boilers remain idle until eaten with rust, and then they are expected to stand 150 lbs. on the inch or burst. Such an invention might have saved the lives of two men yesterday at Bay City, Mich."

UNDERGROUND RAILWAYS IN AMERICAN CITIES.

The city of Baltimore now boasts of the possession of a splendid underground railway, the first ever constructed in this country. From all accounts, the new works are highly creditable to the city and the enterprising individuals under whose auspices they have been executed. Two distinct lines of tunnels have been made at Baltimore, at an expense of some five millions of dollars, whereby nearly all of the various railways now centering in the city have their tracks united. The conveniences of the public and the mercantile facilities of the city are thus greatly improved.

The Underground Railway consists of the Baltimore and Potomac tunnel, of which the western portal fronts on Gilmore street, whence it extends in a northeasterly direction through the city, under some twenty-nine streets and avenues, emerging at North avenue, where it joins the track of the Northern Central Railway.

The Union Tunnel extends, from tide water at the Canton portion of Baltimore, northerly and then easterly under some thirteen streets and avenues to the Northern Central Railway.

The total length of the Baltimore Underground Railways is 3½ miles, of which about two miles are closed tunnels, and the remainder open cuts, over which the streets are carried on bridges.

The tunnel arches are from 22 to 23½ feet high and from 26 to 27 feet wide, five rings of brick thick, backed with rubble masonry. Only a portion where the ground was soft and springy required the invert arch. The springs of the arches are of masonry.

The Baltimore Underground Railway passes through the finest section of the city, where the people of wealth and fashion reside; but no one is disturbed, and the streets and avenues are not in the least interfered with.

Passengers from New York to Washington can now pass through Baltimore by the new Underground Railway, thus shortening the time of transit from twenty to forty minutes. The tracks of the Philadelphia, Wilmington and Baltimore, the Northern Central, the Baltimore and Potomac, and the Western Maryland now connect with the Underground Railway.

It will be remembered that the Legislature of this State at its recent session granted concession for an underground railway in this city, to extend from the Battery under Broadway to Central Park, a distance of five miles, with a branch under Madison avenue to Harlem river, a distance of six

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miles additional—eleven miles in all. The soil is admirably suited to the work, while the route is almost a straight line. This road will doubtless enjoy the largest and most remunerative traffic of any city railway in the world, as it passes directly under a thoroughfare which is at once the business heart of the city and the central line of travel. Arrangements for the construction of this road are now in progress.

SNAKE POISONS.

Twenty thousand people, it is stated, yearly die, in Hindostan alone, from the effects of the bites of venomous serpents. It is a strange fact that this poison, so deadly and virulent in its effects, may be swallowed with impunity. Its action seems to be the complete paralyzation of the nervous centers through the medium of the blood, in which it spreads through the body with lightning rapidity. Applied to the mucous membrane it causes violent local inflammation; and absorption quickly taking place, the symptoms of general poisoning are soon apparent. The effects of the venom depend, first upon the nature of the snake, the quantity and quality of the poison, and the circumstances under which the bite is given; second, on the species, size and vigor of the living creature receiving the wound.

M. Fayrer, professor in the Medical College of Calcutta, has recently published a work on the serpents of India, in which, referring to the action of the virus upon the blood, he says that, though he has been unable to detect any change in the appearance of the corpuscles, yet there is no question but that some alteration takes place. In inferior animals the bites of vipers destroy in the blood the coagulating faculty, while, on the other hand, by the venom of colubrines, coagulation after death is not interrupted. Again, when inoculated by the poison of the cobra, the blood immediately coagulates, but remains liquid if the bite be given by the daboia. Experiments made in this country with the rattlesnake show that the effects of its venom upon the human blood are quite apparent. Dr. Burnett, in a paper read some time ago before the Boston Natural History Society, gives an account of a microscopical examination, during which the smallest quantity of poison, taken from the fangs of a large rattlesnake, was presented to blood freshly drawn from the finger. A change was immediately perceived; the corpuscles ceased to run and pile together, and remained stagnant, without any special alteration of structure, and the whole appearance was as though the vitality of the blood had been suddenly destroyed, exactly as in death from lightning. This agrees, also, with another experiment, performed on a fowl, where the whole mass of the blood appeared quite liquid, having little coagulable power.

Analyses of cobra poison have lately been made by Mr. Henry Armstrong, of London. The matter, extracted from full grown serpents, was forwarded from India in small vials, and appeared to be a brownish, sirupy liquid; from which, when the vessels were uncorked, a quantity of gas escaped. Examinations were made, first, of the crude substance, second, of the precipitate caused by the addition of alcohol, and finally of the residue obtained by evaporating the filtered spirits, with the following results: The raw poison evaporated with sulphuric acid in *vacuo* deposited a friable mass which contained 43·55 per cent carbon and 13·43 per cent nitrogen. The white precipitate dried with sulphuric acid, under similar circumstances, appeared as a pale brown substance, easily pulverized, and leaving, after incineration, a light mineral residuum. It contained 45·3 per cent carbon and 14·7 per cent nitrogen, and also 2·5 per cent of sulphur was determined. The alcoholic solution, similarly evaporated, left a light brown friable mass, composed of 43·04 per cent carbon, 12·45 per cent nitrogen, and 7 per cent hydrogen. It was found impossible to crystallize the poisonous substance, neither water, alcohol, ether, bisulphide of carbon, or any other dissolvent employed leaving the slightest trace of crystals after evaporation. Nitric acid and alcohol determined a coagulum; heat produced the same effect. The salts of copper and potash caused the violet color characteristic of the presence of albuminoid matter.

The liquor, it appeared, resisted decomposition and maintained its activity even after being kept for considerable time, and the characteristics of the poison were noted to be equally powerful in all the three states above mentioned.

M. Fayrer considers that to cobra poison may be ascribed a nature similar to that of vaccine virus, and believes that much may be discovered by extended experiment. He says that viper venom acts directly on the blood and secondarily on the nervous system, and adds that it may be that, by careful and reasonable employment, this powerful poison may be converted into a useful remedy, and that there is nothing to prove why, by extended experiment and study, a complete and prompt antidote may not be found.

From all accounts it appears that the rattlesnake (*crotalus durissimus*) indigenous to this country is endowed with a poison even more virulent than that of the cobra or viper. There is reason for belief that its action is the same upon all living things, vegetables as well as animals. It is even fatal to the snake itself; and we find it stated that, on being irritated while confined in a cage, the animal has been known, in moving suddenly, to strike its own body, and to die from the wound as quickly as would any other creature. A remarkable physiological fact is here presented of a liquid, secreted directly from the blood, which proves deadly when introduced into the very source from which it was derived. Serpent poison acting as a powerful sedative, active stimulants are probably the best antidotes. Hence, in parts of the United States infested with venomous reptiles, it is the practice to administer large drafts of whisky, or to chew and swallow tobacco. The liquor stimulates the nervous system until the depressing effect of the poison is overcome by natural curative action. Tincture of iodine externally applied and administered by hypodermic injection into the cellular tissue near the wound is said to be of considerable efficacy, and in advanced cases chloride or iodide of potassium, largely diluted with water, is given in addition. Sucking the wound immediately after being struck often delays the spread of the poison. The negroes in the South favor an odd remedy, which consists in killing a chicken, splitting it in the back, and bending the warm flesh directly over the bite. They believe that the poison attacks the fowl in preference to transfusing itself through the human body. The Mexicans and Indians use a plant which they call the *golondrinera*, which Dr. Torrey on examination pronounced a species of *euphorbium*. Botanically it is known as *e. prostrata*; and we find it described as a plant of frail, delicate appearance, somewhat like the gold thread, and having long, reddish stems that spread and interlace with each other. Its flowers, which appear from April to November, are very small and white, with dark purple throats. They are axillary, and have four petals and four sepals. All parts of the plant contain an abundance of milky juice in which the medicinal properties reside, and which is extracted by bruising the portions in a mortar. A considerable quantity of water is added and several ounces of the mixture administered to the injured person. The plant grows plentifully in dry gravelly places, by roadsides and in farm yards. The remedy, which acts as an emetic and cathartic, is said never to fail in a cure and to be attended with no danger in its administration.

TO EUROPE IN A BALLOON.

To accomplish this has long been the favorite project of the well known aeronaut Mr. John Wise, and for the past twenty years he has kept the matter before the public. During this period, he has made a large number of balloon ascensions, and gathered, as he believes, indubitable evidence of the existence in the aerial regions, at a hight of from one to two miles above the earth, of a constant easterly wind current, and has alleged that if proper efforts were made it would be practicable, by maintaining a balloon within this current, to pass easily and speedily over from this continent to Europe. In 1859 Mr. Wise undertook a preliminary land voyage, and succeeded in moving in an easterly direction for a distance of some twelve hundred miles—to wit, from St. Louis, Mo., to Jefferson county in this State. But the results of that excursion appear to have dampened the interest of financial people, and the daring balloonist has, until quite recently, been unable to find anybody who, for the sake of science or any other consideration, was willing to risk the expense of a few thousand dollars for another trial.

We are glad, however, to be able to chronicle the fact that the Messrs. Goodsell, the enterprising publishers of the *Graphic* daily illustrated newspaper in this city, have pledged themselves to supply all the funds necessary for a new flight to Europe; and in a few weeks from the present time, as soon as the balloon can be manufactured, Mr. Wise will be again in the air.

Our readers are no doubt familiar with the form of contracts for building houses, ships, railways and various kinds of machinery; but probably they have never read the details of a contract for the building of a balloon and a voyage therewith to Europe. We will therefore give the text of the bargain between Messrs. Goodsell, the financial parties to the contract, and Messrs. Wise and Donaldson, the aeronautic directors of the expedition:

CONTRACT FOR THE CONSTRUCTION OF THE GRAPHIC COMPANY'S BALLOON, AND ITS NAVIGATION FROM NEW YORK TO EUROPE.

This memorandum of agreement, made at the city of New York, the 27th day of June, 1873, by and between The Graphic Company, proprietors and publishers of the *Daily Graphic*, party of the first part, and John Wise, of Philadelphia, party of the second part, and Washington H. Donaldson, of Reading, Pa., party of the third part, witnesseth:

That the said The Graphic Company will build a balloon of not less than 130 feet in hight and 100 feet in diameter, and will fully equip and provide the same with valves, balance line, ropes, car and gallery, life boat or raft, and all other appliances necessary to insure strength and safety in so far as may be practicable. It agrees that the construction of the same shall be commenced at once and pushed to completion as rapidly as possible, and before the 20th day of August next if practicable; and the said The Graphic Company will furnish the use of said balloon to said John Wise and said Washington H. Donaldson for the purpose of the making of an aerial voyage therein by the parties of the second and third parts from the city of New York to some point on the eastern side of the Atlantic Ocean upon the conditions following:

First. That the said John Wise and the said W. H. Donaldson shall personally superintend and direct the construction of the balloon according to the utmost of their skill and judgment, and that in all matters connected with the construction of such balloon they shall be subject to the general direction of The Graphic Company.

Second. That the said John Wise and the said W. H. Donaldson shall not make nor participate in any other balloon enterprise, exhibition, or ascension while this agreement is in existence.

Third. That on the completion of the said balloon the said John Wise and the said W. H. Donaldson shall, on a day and from a starting point to be selected by The Graphic Company, make a public ascension in such balloon, accompanied by such other persons as may be designated by The Graphic Company; and making such ascension, that they shall, directly and without any delay or evasion, seek the elevation of the eastern air current, there to remain until land shall have been made on the eastern side of the Atlantic Ocean.

Fourth. That the said John Wise and said W. H. Donaldson shall then land said balloon as safely and expeditiously as possible, and immediately thereafter communicate the intelligence of their arrival, with full particulars of the voyage, by the most speedy means available, to the *Daily Graphic*.

(Signed) JAMES H. GOODSELL, C. M. GOODSELL,
Managers of The Graphic Company.
JOHN WISE. WASHINGTON H. DONALDSON.

The foregoing preliminaries having been duly settled, the work of construction was begun on the very next day, June 28th, and will be pushed forward rapidly to completion. The editor of the *Graphic* says: "Although it is impossible to fix definitely the day of departure, yet we are confident that everything will be in readiness before August 20 next. We have lent our aid to the undertaking in the interest of science and business, and the progress of mankind. The balloon will not be exhibited to the curious to make a sensation, but, as soon as it is finished, will take its flight. We have reason to believe that the public will not be disappointed or dissatisfied either with the method of the undertaking or the manner of its performance.

"It is needless for us to enlarge upon the benefits which will result from the success of this enterprise. They may be easily imagined, if they are not obvious at once. The discomforts, the risks, the cost, and the perils of the ordinary ocean voyage are familiar enough. The path across the ocean has been paved with human bones. Millions of treasure have gone down beyond recovery. To demonstrate the practicability of aerial navigation is to revolutionize the business and communication of the world. To demonstrate its impracticability, even, would be a positive gain; but once sail to Europe through the air in sixty hours, once acquire practical mastery of the methods of navigating the air and the difficulties of the route, and there is no telling what grand results may follow."

Of all newspaper dodges to attract interest and induce large sales, this "Balloon to Europe" affair beats all. The pictorial representations of the progress of manufacturing the great machine, its inflation, trial, and final departure, will be fruitful themes for the artist's pencil, and the voyage, if successful, will supply an extensive series of *Graphic* illustrations, of "Life in the Clouds," exceeding in interest everything of the kind before produced. The steam presses of our enterprising cotemporary will have to be several times duplicated and run night and day for many weeks in order to supply the public demand.

The balloon is now being made in the lofts of the Domestic Sewing Machine Company, corner Broadway and 14th street.

In a letter to the *Graphic*, Mr. Wise says:

"The balloon proper will be a spheroid of 100 feet transverse, and 110 perpendicular and diameter. The supplemental balloon will be a spheroid of 36 feet diameter. These, with allowance for expansion of gas, will give us a lifting power of 15,900 pounds, and a net carrying power of 9,500 pounds, and of disposable ballast, 7,500 pounds. Our floats will not lose by exosmose of gas over 15 pounds per hour, and that will enable us to keep afloat 20 days. But allowing a liberal margin for the free escape of gas in the higher and rarefied regions of the atmosphere, we may still calculate safely for a ten days' buoyant power; and, if deemed necessary, we can dispose of the boat and gallery, and thus restore a buoyant force of 1,200 pounds, which would serve us for several days more; so that, under the most adverse circumstances, we can hardly fail to reach the European shore.

"We shall carry a boat more for the purpose of providing for a contingency that may possibly arise, from any damage to the main balloon, but one that we have little cause to apprehend. The boat will be stored with water and provisions to serve for thirty days. Our kind friends are thus assured that we are not foolhardy, seeing that we shall provide against all and any contingencies that are likely to possibly arise.

"Our main reliance is on the great eastward drift of the trade wind. We do not pretend that, in this first experimental voyage, we shall be able to make a given point on land, but we have an eye to the Gulf Stream, the great warm river in the ocean, which forms above it, in the ocean of air, a corresponding aerial river that will float us to the coast of Ireland."

The editors of the *Graphic* announce that the balloon will have passenger room for eight or ten persons, and the choice few who wish to take part in the expedition may now call at the captain's office, 41 Park Place, and purchase their tickets.

We recommend those who are tired of life, who have made their wills, who have no one dependent upon them and whose friends would be glad to be rid of them, to prepare carpet bags and go. The chances of their return to earth in a condition suitable for further usefulness, we regard as extremely slim. When Mr. Wise made his great voyage from St. Louis, he had twelve hundred miles of land to pass over, and descended before reaching the sea. By starting from New York, this long stretch of overland travel will be saved, and in a very short time after cutting the rope he will be wafted out over the trackless deep, provided he seeks and gains the high easterly current aforesaid.

The balloon which he proposes will, we believe, be the largest ever made. That of M. Giffard, used in London in 1869 for elevating passengers at Ashburnham Park, by means of rope and reel, was 93 feet in diameter, and held 425,000 cubic feet of hydrogen gas. It was made of three thicknesses of linen, cemented with rubber and varnished with shellac. Cost $10,000. It was capable of lifting 25 persons besides the cable by which the balloon was drawn down after every ascent, steam power being used. The cable weighed 4,350 lbs., and was 2,150 feet in length.

THE GREAT BALLOON VOYAGE OF 1859.

We will now give a history of the great voyage made by Mr. Wise, in 1859, from Missouri to New York, as published in our paper at that time:

[From the SCIENTIFIC AMERICAN of July 16, 1859.]

"The veteran aeronaut, Mr. John Wise, has long entertained the idea that a successful balloon voyage across the

(Conclusion on page 41.)

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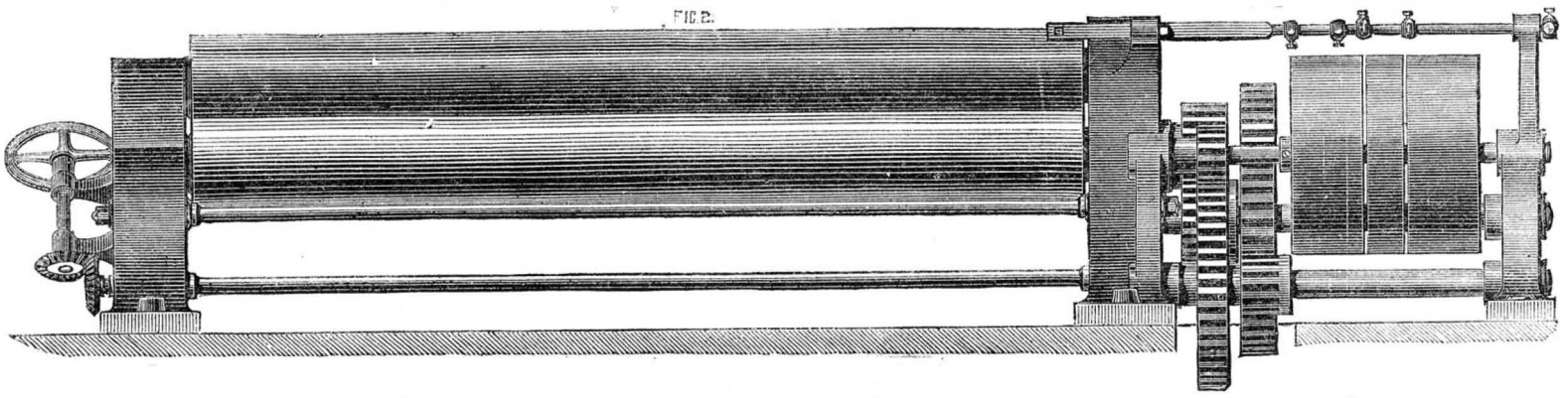
NOTES FROM THE VIENNA EXPOSITION.

RIGHTS OF WOMEN IN VIENNA.

A correspondent of the *Baltimore American*, who is in attendance at the exhibition, speaks of an immense building, occupying a whole block, in course of erection in Vienna, on which not less than 400 persons are employed, fully 200 of whom are women. All the hard laboring work is done by women, such as making and carrying mortar in buckets on their heads to the workmen, and handling the brick. They are not allowed a moment's leisure, several overseers being on guard to keep them constantly in motion. "We found the same proportion of women at work on all the new buildings, and there must be many thousands of them today doing this species of laboring work in Vienna. There are young, middle aged, and old women, but all seem to be strong and healthy. At dinner time they swarm into the shops to purchase a piece of brown bread, and eat their dinners sitting on the curb-stones. The wages are one florin, or forty-eight cents per day, and I am assured by a gentleman resident here that most of them sleep about the building on shavings, or in barns or sheds, having no homes. It is not to be wondered at that, of the 8,000 births annually in the lying-in hospitals of Vienna, less than 500 are of children born in wedlock."

PLATE BENDING ROLLS.

Among the metal working appliances is found a plate bending machine, shown, by the *Chemnitz Werkzeug Maschinen-Fabrik*, of which we give an illustration selected from *Engineering*. The rolls are 7 feet 4·58 inches long and 9·84 inches in diameter; and the pulleys are arranged so as to drive, through double gear, backwards and forwards. The uppermost roller is raised by a very ingenious arrangement. The hand wheel, shown in both views of our engraving, communicates motion through a pair of bevel wheels to a horizontal spindle traversing the whole length of the rolls. This spindle has two worms on it which give motion to the worm wheels, one of which is seen in the end view on the outside of two columns lying underneath the gudgeons of the roller. The rotation of the worm wheels raises the roller (shown in its lowest position in the engraving) by means of internal screws. The machine, the workmanship of which has been highly spoken of by some cotemporaries, is intended to bend plates up to three fourths of an inch in thickness.



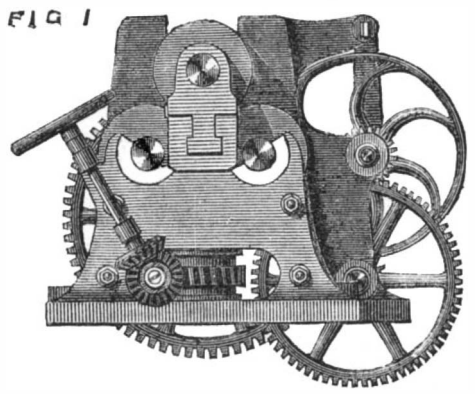


PLATE BENDING MACHINE.

POTASH SALT.

The mines from which this product is obtained are very valuable, since there is no competition in the market. There are only two of these mines, one of which is in Germany, at Leopoldshall and Stassfurt, and the other in Austria, at Kalusz. Mr. Kustel writes, to the *Mining and Scientific Press*, from Vienna, that a very complete exhibition of potash and its productions can be seen at the Vienna Exposition. He says, in referring to the mines mentioned above, that it is the belief that these potash deposits are the result of the evaporation of former remainders of large seas, concentrated in a few favorable localities. The formation of these deposits, under such peculiar and lucky circumstances, indicates that little prospect for new discoveries exist in this line, but it is not impossible that such deposits may be found in the United States, in districts where salt rock is known to exist. Although the potash was known and used in many branches of industry long ago, its large and extensive application in practical life is not older than the discovery of the Stassfurt deposit (twelve or fifteen years ago). Formerly, the potash salt that covered the salt rock bed was considered a nuisance; it was not utilized; its value not known; and now, not the immense bed of salt rock, but the above nuisance is considered the wealth of Stassfurt. Eight millions of thalers were offered for that part of the deposit which is in Stassfurt, but the offer was not accepted. The total extraction of this salt in 1872, at Stassfurt and Leopoldshall, was eleven millions of hundredweights. This shows what extensive use is made of this article in agriculture and trade.

A LARGE LOCOMOTIVE.

The new Belgian exhibit, says *Engineering*, is by far the largest locomotive in the collection at Vienna, it being an engine on Meyer's system, having two steam bogies, each with a pair of cylinders $17\frac{5}{16}$ inches diameter and 1 foot $7\frac{1}{16}$ inches stroke. Each bogie has six coupled wheels, 4 feet in diameter, placed with a wheel base of 8 feet $8\frac{3}{16}$ inches, the total wheel base of the engine being 28 feet $7\frac{3}{4}$ inches. The boiler has a barrel of 4 feet 11 inches in diameter outside, and contains 289 tubes, $1\frac{3}{32}$ inches diameter outside and 14 feet $9\frac{1}{8}$ inches long between tube plates, these tubes giving an external heating surface of 2199 square feet. The fire-box surface is $128\frac{1}{2}$ square feet, making $2327\frac{1}{2}$ square feet of heating surface in all, while the firegrate area is 33·6 square feet. The tanks carry 1760 gallons of water, and the weight of the engine is 55 tuns empty, or 71 tuns in working order. This engine is intended for service on the Grand Central Railway of Belgium, and it is exhibited by the maker, M. Charles Evrard, of Brussels, who has materially improved MM. Meyer's original design.

RUSSIAN MALACHITE.

The malachite work is perhaps the most beautiful of anything that is peculiarly Russian in the exhibition. No one who has only seen this stone, says the New York *Tribune* correspondent, with its graceful veinings and mottlings of dark and light green, in small pieces in jewelry, can realize its beauty when used in combination with gilt in large vases, clocks, and for the tops of tables. The finest marbles or even jasper do not compare with it. The Russians alone possess the stone; but in its cutting they develope nothing original, and only copy French and Italian forms.

RUSSIAN WAR MATERIALS.

The Russian Government makes a complete exhibit of her weapons of war, and, so to speak, shows her teeth to the world. Here are specimens of shot and shell, field artillery and mitrailleuses,

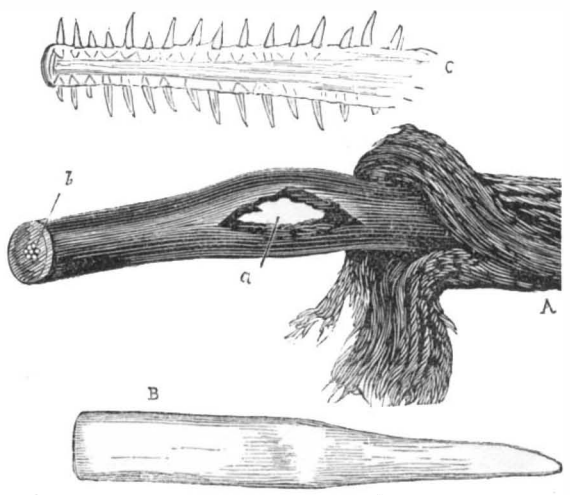
GATLING GUNS,

and American racks of breech loading small arms (Berdan's system, an American invention), cartridges and cartridge machines, tents, ambulances, accoutrements of all kinds, uniforms, models of navy yards and iron clads—in a word, all the paraphernalia of war by sea and land.

A Sawfish Cuts a Telegraph Cable.

In the SCIENTIFIC AMERICAN of February 17, 1872, we gave some account of the injury to the telegraph cable between Florida and Cuba, from the bites of sea turtles or other fish; and also of injuries to cables submerged in the China Sea, occasioned by the attacks of marine insects. Another enemy to telegraph cables has made its appearance in the shape of the sawfish, who has been guilty of using his teeth upon the Singapore and Penang cable, and thereby suspending telegraphic communication. Mr. Frank Buckland, in a recent number of *Land and Water*, gives the following interesting account and engraving:

The drawing is made the actual size of the injured portion of the cable. A hempen rope, A, is tightly coiled round the gutta percha portion of the cable. This was, of course, underneath the iron wires which formed the outside of the cable. In the middle of the gutta percha the copper wires are seen embedded at *b*. In the middle of this gutta percha there is a jagged hole, exactly the size and shape of that given in the drawing. A minute observation of the interior of the wound will show that three of the wires at this point are snapped right across, the broken ends being all thrust in the same direction, namely, away from the spectator as he examines the drawing. The remaining four wires (there



are seven at the point *b*), however, remain intact. The uninjured wires can be seen at the lower side of the wound, the weapon which made the hole having missed them.

The following information was received from Colonel Glover, R. E.: "The cable was laid on December 11, 1870, and its tests were satisfactory. It worked well until March 1, 1871, or three months afterwards, when a serious fault had developed itself, which prevented working. A vessel went out, found the fault, and repaired it on the 7th June, 1871. The fault was 222 miles from Singapore, and in thirty fathoms water, the bottom being marked sand and mud. The report which came home to us was that a bony substance had been found jammed hard in the cable through the wires, and it was supposed to have been done before laying. As we could not understand why the original tests should be good if the substance had not existed, and why failure should be sudden, I did not believe this; and on receiving the faulty specimen I went to Willoughby Smith, and we opened it together. The bony substance appeared to us a fish tooth, probably a shark's; but as no mark of the other jaw appeared, we were puzzled, and give it to you. This is all the information we possess, nor, indeed, can get more, as no persons have seen it since."

I confess I was exceedingly puzzled with this most difficult problem. The hole towards the spectator is two thirds larger than it is on the opposite side. If it had been an ordinary fish, such as a shark, there ought to have been the marks of a bite on both sides of the cable, namely, of a tooth in both the lower and upper jaws. This wound, therefore, must of necessity have been made by a fish having but one tooth, and one tooth only; but what fish is there that has only one tooth? For several weeks I placed the specimen on my mantlepiece, and was constantly thinking over the puzzle. At last one day I hit it off all of a minute. On going round my museum I observed with most intense interest a beak or saw of a sawfish (*pristis antiquorum*) presented to me by Dr. Day, Inspector of Indian Fisheries, the fish having been taken in the Andaman Islands. "That's the fellow," I said to myself, "that made the hole in Mr. Latimer Clark's telegraph cable;" so, taking one of the teeth out of the beak of the sawfish, I placed a spare portion of the telegraph cable on the table, and struck the end of the tooth with the mallet, and immediately produced a wound almost, I may say exactly, similar to that found on the Penang telegraph cable. This tooth is seen at B.

My theory is very simple, namely, that the perpetrator was a big sawfish. The cable lay at the bottom of the sea, when day a sawfish came by hunting for his dinner. The sawfish gets his food by waving his saw right and left, turning up the mud or sand in order to dislodge the delicate bodied marine creatures on which he subsists. His teeth will tell us he cannot eat hard substances. When thus engaged in his submarine diggings, he suddenly came across the telegraph cable. His beak getting entangled in it, he gave it an extra blow and a smash downwards, and finally, getting enraged, hit it so hard that one of his teeth went between the outer wires—through the hempen rope—and then through to the gutta percha, injuring the wires. These various substances probably then held the tooth somewhat tightly. The fish then struggled and broke his tooth short off, leaving a bit of it actually imbedded in the cable among the wires.

I am inclined to think that the sawfish uses his formidable weapon to stir up the mud in search of his food, because the points of the teeth in the saw, which are composed of very hard bony substance, are as sharp as the tips of a wild boar's tusk, which are kept finely pointed by constant friction.

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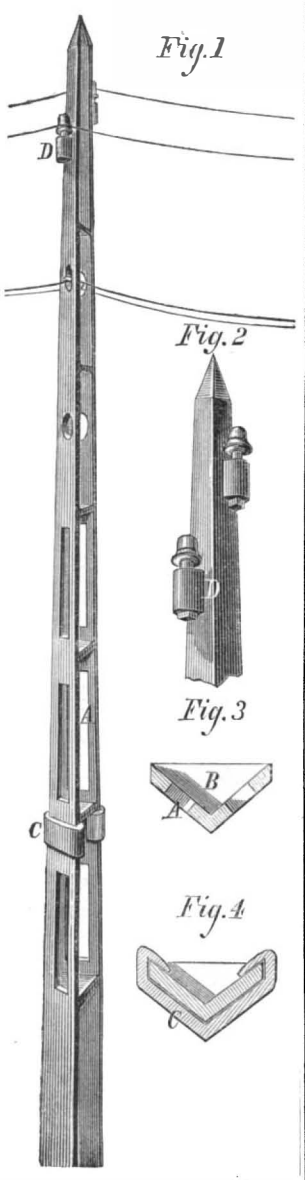
NEW FORM FOR METALLIC TELEGRAPH POLES.

We presume that there are few who, in common with ourselves, have not been impressed with the unsightliness of the cumbrous wooden telegraph poles which disfigure the finest thoroughfares of our large cities. Huge tall posts, often crooked, with their defects made still more glaring by a coat of white paint, far from correspond with handsome stone façades or elegant architectural adornment. Hence it may be imagined that any substitute, particularly if made of metal, such as the novel invention herewith illustrated, and of a neat and graceful design, will receive favorable consideration, both from telegraph companies, in point of its superior economy, and on account of its unobtrusive and even ornamental appearance from those charged with the improvement of our city streets.



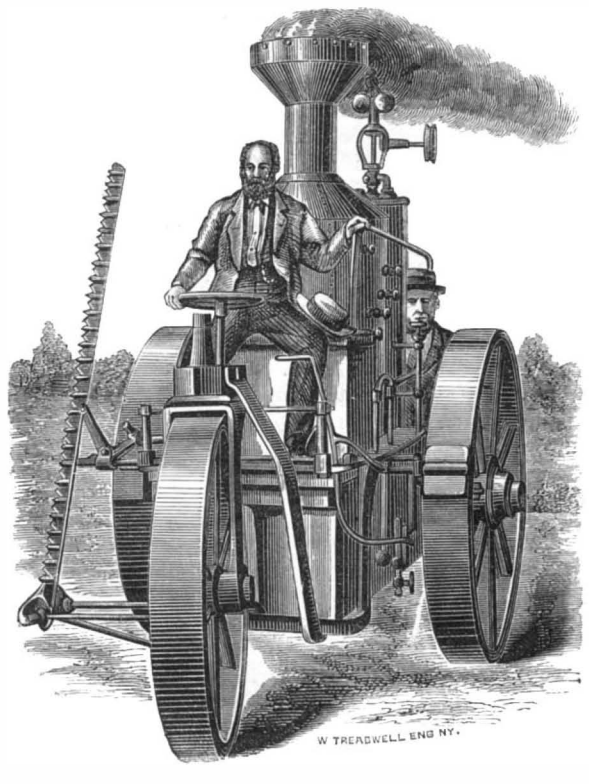
The posts are made in sections, of either cast or rolled angle iron, and constructed of the form shown in Fig. 1, that is, tapering from the base to the top; and when made of cast metal the wide flanges have long openings or slots, A, in which pins may be inserted to adjust the wires. A horizontal section of these portions is represented in Fig. 3. The cross pieces, B, by which to climb, may be cast in the angle between the wires.

The sections are connected together by slips, C, Figs. 1 and 4, on the end of one section; between which and the extremity of said section, the end of the adjoining portion is slid in. Similar clips, or dovetailed grooved clips, D, are applied to the upper ends of the top sections, Fig. 2, for the reception of the insulators for holding the wires.

It is claimed that posts of this form are cheaper and more durable than those of any other pattern now in use. Patented through the Scientific American Patent Agency, June 3, 1873. For further particulars address McCarver, Athey & Jennings, Oregon city, Oregon.

CUMMINGS' STEAM MOWING, REAPING, AND THRASHING MACHINE.

Some issues back, we published an engraving and description of the Hayes steam reaper, an agricultural invention of considerable merit recently introduced in England. The article attracted the notice of a correspondent, Mr. Marcellus



V. Cummings, of Geneseo, Henry county, Illinois, who has lately forwarded to us the facts, embodied in the following description and illustrated in the annexed engraving, relative to a machine of similar description, invented and patented by him (May 12, 1868) over five years ago, which, he informs us, is now in actual and successful use in the above mentioned locality. Our illustration, from a photograph, will convey an excellent idea of its appearance and construction. The boiler is thirty-one inches in diameter by five feet in length, and is of the tubular pattern. There are two steam cylinders, each four by eight inches, together with a water tank holding five barrels of water, and coal bunkers containing five bushels of coal. The large driving wheels are five feet in diameter and eight inches in tread; the front steering wheel, operated as shown, is four feet in diameter, with similar tread. The grass sickle cuts six feet four inches and the grain sickle nine feet six inches.

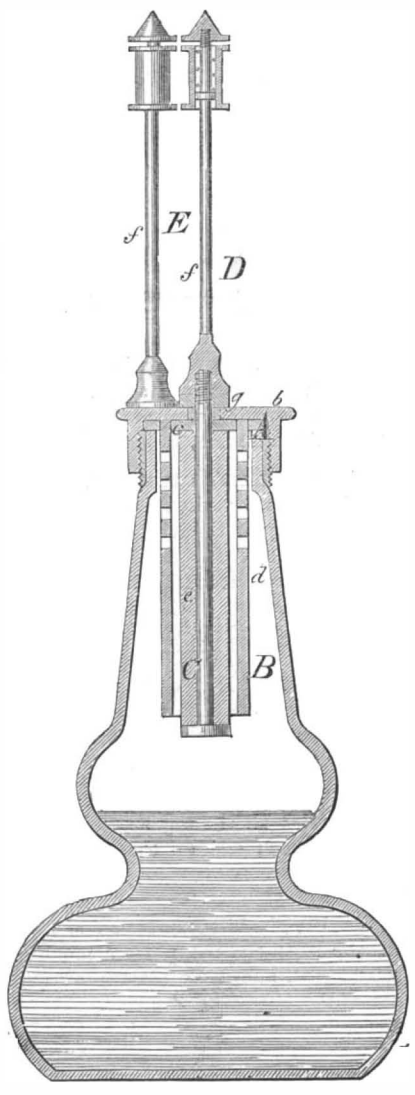
The inventor states that he drives his engine from farm to farm without the aid of horses, and that it traverses over plowed land, up hill or down, with the greatest ease. The rate of speed is about four miles per hour, and an acre of ground can be mown in twenty minutes. The grain thrashing machine is placed on a two wheeled carriage, which is coupled on behind the engine, and is thus hauled by the latter over country roads, from place to place, throughout whole counties. The entire weight of the apparatus is 4,200 lbs.

Judging from the facts transmitted to us, this invention appears of considerable importance and worthy of the attention of farmers having large tracts of land under cultivation. The patentee states that his means did not admit of his constructing more than one machine, by the aid of which, however, he has earned sufficient to build another. If, as he asserted, and doubtless with truth, its advantages, both in itself and as a traction engine, are so extended, it amply deserves a reputation much wider than it has attained.

ELECTRIC GAS LIGHTER.

We are indebted to the Belgian *Bulletin de Musée* for the accompanying illustration and description of an ingenious gas-lighting apparatus, the invention of Dr. Klinkerfues. The principle of the device is the heating of a coil of fine platinum wire, by a weak current of electricity, to a sufficient temperature to ignite the gas.

The invention is composed of a glass vase of suitable shape, closed by a cover screwed on, and packed so as to exclude the air by a rubber plate, A. The two elements, B and C, are zinc and graphite, the former is in the shape of a tube, is pierced with several holes, and is attached to the



cover. The graphite is in the form of a cylinder and is secured as described further on. Upon the cover are the two electrodes, D and E, consisting of rods of brass at the upper extremities of which are spring clamps which hold the spiral of platinum wire. One electrode, D, is attached directly to the cover, the other, E, carries the graphite cylinder, and is isolated at its point of contact with the cover by a rubber envelope.

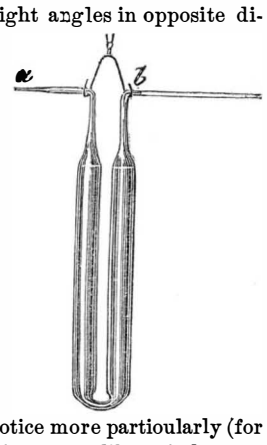
The liquid contained in the vase is composed of three parts chromate of potash, four of sulphuric acid, and eighteen of distilled water. To use the apparatus it is only necessary to slightly incline the vase so that the liquid is brought in contact with the elements. A current is established which heats the platinum by which the gas is lit. On returning the device to its vertical position, the fluid rests at the bottom and the current is interrupted.

The same inventor has arranged a similar plan for the automatic lighting of jets, the apparatus being placed upon the burner. During the day, while the pressure of gas is low, or when the supply is partially or wholly turned off, the liquid is not in contact with the zinc and graphite; but on admitting a greater pressure, the fluid is forced up and a current established. This device, hardly so practical in form as that above described, was fully explained on page 393 of our volume XXIV.

SPECIFIC GRAVITY INDICATOR.

Dr. Hermann Sprengel says, in the *Journal of the Chemical Society*: "I have, for a number of years, availed myself of pipette shaped vessels in preference to the usual specific gravity bottle, the following being a short description of my method:

"The form of my instrument, Fig. 1, is that of an elongated U tube, the open ends of which terminate in two capillary tubes, which are bent at right angles in opposite directions. The size and weight of this instrument should be adapted to the size and capability of the balance in which it is to be weighed. The instrument which served for my determinations had a length of 7 inches, and was made of a glass tube, the outer diameter of which was $\frac{7}{16}$ of an inch. It hardly need be mentioned that the U shape is adopted for the sake of presenting a large surface, and so rendering the instrument sensitive to changes of temperature. The point, however, which I wish to notice more partioularly (for reasons explained below) is the different caliber of the two capillary tubes. The shorter one is a good deal narrower (at least towards the end) than the longer one, the inner diameter of which is about ·02 of an inch. The horizontal part of this wider tube is marked near the bend with a delicate line, *b*. This line and the extremity of the opposite capillary tube, *a*, are the marks which limit the volume of the liquid to be weighed.



The filling of the instrument is easily effected by suction, provided that the little bulb apparatus (as represented in Fig. 2) has previously been attached to the narrow capillary tube by means of a perforated stopper, that is, a bit of india rubber tube, tightly fitting the conical tubulus of the bulb. On dipping the wider and longer capillary tube into a liquid, suction applied to the open end of the india rubber tube will produce a partial vacuum in the apparatus, causing the liquid to enter the U tube. As this partial vacuum maintains itself for some time (on account of the bulb, which acts as an air chamber), it is not necessary to continue the suction, if the end of the india rubber tube be timely closed by compression between the fingers. When bulb and U tube have about equal capacity, it is hardly necessary, during the filling, to repeat the exhaustion more than once. Without such a bulb, the filling of the U tube through these fine capillary tubes is found somewhat tiresome. The emptying of the U tube is effected by reversing the action and so compressing the air.

"After the U tube has been filled, it is detached from the bulb, placed in water of the standard temperature almost up to the bends in the capillary tubes, left there until it has assumed this temperature, and, after a careful adjustment of the volume, it is taken out, dried, and weighed.

"Particular care must be taken to insure the correctness of the standard temperature, for a mistake of 0·1°, causes an error in the 5th decimal, making 100000 parts 100001·4 parts.

"A peculiar feature of my instrument is the ease and precision with which the measurement of the liquid can be adjusted at the moment it has taken the standard temperature; for it will be found that the liquid expands and contracts only in the wider capillary tube, namely, in the direction of the least resistance. The narrow capillary tube remains always completely filled. Supposing the liquid reaches beyond the mark, *b*, it may be reduced through capillary force

by touching the point, *a*, with a little roll of filter paper. Supposing, however, that in so doing too much liquid is abstracted, capillary force will redress the fault, if point, *a*, be touched with a drop of the liquid under examination; for this gentle force acts instantly through the whole mass of the liquid, causing it to move forward again to or beyond the mark.

"As the instrument itself possesses the properties of a delicate thermometer, the time when it has reached the standard temperature of the bath may be learned from the sta-

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ility of the thread of liquid inside the wider capillary tube. The length of this thread remains constant after the lapse of about five minutes.

"In wiping the instrument (after its removal from the bath) care should be taken not to touch point, *a*, as capillarity might extract some of the liquid; otherwise the handling of the instrument requires no especial precaution.

"The nicety attainable by this method is very satisfactory."

[From the Fourth Annual Report of Charles V. Riley, State Entomologist of Missouri.]

THE GREAT LEOPARD MOTH.

There is a large family of moths, known as Arctians or tiger moths, which is rendered conspicuous by the beauty of design and boldness of contrast in color which its members generally present. There are two whose caterpillars are often seen, either rolled up cozily under some plant or crawling rapidly across a path, but which are not by any means generally known in their more beautiful and perfect states. They were both more than usually common the past year, and both have very similar habits. They neither of them can be considered injurious; but a brief account of their transformations, in this department of my report, will doubtless please and gratify many an inquisitive reader, who has wondered what the "hedge hog" caterpillars produce.

The species above named is the largest, and perhaps the most beautiful, of the family in North America.

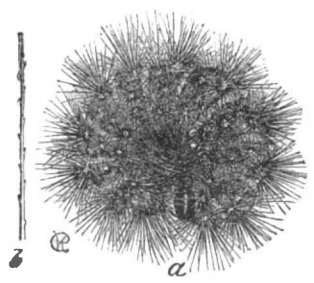

Fig. 1.—The Leopard Moth Larva.

Its larva (Fig 1) may be called the large black bear, as the hairy worms of our different Arctians are popularly called bears, and the family name was derived from the Greek word for "bear." It is often observed in the fall of the year, though few persons have ever seen the moth which it produces. This larva is black, and so thickly covered with jet black spines as almost to hide a series of roughened warts, on each joint, from which the spines spring. When disturbed, it curls itself up, and then the sutures of the joints are seen to be reddish brown, in strong contrast with the black of the rest of the body. If carefully observed, the spines will be seen to be barbed, as represented at *b*.

This worm feeds, mostly during the night, upon the wild sunflower (*helianthus decapetalus*), the different species of plantain (*plantago*), and upon willows. J. A. Lintner, of Albany, N. Y., thinks it likewise feeds on black locust, as he has often found it beneath that tree and has fed it on the leaves. It comes to its growth in the fall, and curls up and passes the winter in any shelter that it can find, being especially fond of getting under the bark of old trees. In the spring, it feeds for a few days on almost any green thing that presents itself, and then forms a loose cocoon, casts its prickly skin, and becomes a chrysalis. The chrysalis is black, and covered with a beautiful pruinescence, which rubs off almost as that covering a Duane's early plum. It has a flattened blunt projection at the extremity, armed with a few barbs and bristles.

In a few exceptional instances I have known both this and the following species to go through all the transformations and produce the moth in the fall. The chrysalis state lasts but about a fortnight, when the moth escapes.

Fig. 2.—The Great Leopard Moth. *Ecpantheria scribonia*, Stoll. (*Lepidoptera, Arctiadæ.*)

Fig. 2 represents the female moth at *a*, and the male at *b*. The upper portion of the abdomen is steel blue, or blue black, marked longitudinally along the middle and sides with yellow or orange. With this exception, the whole insect is white marked and patterned with dark brown, as in the figures. The male differs from the female principally in his smaller size and more acuminate wings, and by the narrower abdomen, which is also generally duller in color, with the pale markings less distinct. The markings on the wings vary in a striking manner in different individuals, the oval or elliptical rings sometimes filling up, especially in the male, so as to look like black blots. This insect is considered rare in New England, but is much more common in the Mississippi valley. It occurs still more abundantly in the Southern swamps, where the larva is dubbed "fever worm" by the negroes, under the absurd impression that it is the cause of fever and ague.

As an illustration of the wonderful power of resisting extreme cold, which this caterpillar possesses, I will quote the following experience communicated to me by Mr. Lintner. He says: "I had placed one for hybernation in a small keg among leaves, which I inserted in the ground. During my absence from home, either the thawing of the snow or the wind had overturned the keg and driven away the leaves. On my return I found the larva remaining, but stiffly frozen, with its head encased in ice and fastened to the ground. As an experiment I detached a piece of the ground with the larva, and placed it in a warm room. On the thawing of the larva and the release of its head, it was restored to activity."

EN ROUTE TO THE GREAT EXPOSITION.—LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 2.

LONDON, JUNE 10, 1873.

The previous letter was written while on the Atlantic, with more than one half of our voyage accomplished. The remainder of the distance was made under very similar circumstances of wind and sea. Light wind and sea, invariably ahead, or on the bow, while admirably adapted to meet the wishes of those of the passengers who were at all inclined to suffer from sea sickness, prevented our making a quick passage, and we only made the land, at the north of Ireland, after a thirteen days run from New York.

In that high latitude, the sun, at this season, does not set until late in the evening, and it rises correspondingly early in the morning; while the twilight, on a clear night, is sufficiently bright at midnight to enable us to read a newspaper without very greatly fatiguing the eyes.

It was broad daylight, therefore, when, the next morning, at about three o'clock, an unusual bustle on deck announced that they were preparing to set some of our passengers ashore at Moville, a little village in Lough Foyle, a few miles below Londonderry. A chilling breeze met us, as we stepped on deck, and would have at once sent us below again had the scenery been less beautiful.

THE NORTH COAST OF IRELAND.

The green and fertile fields, lying on the slope which extends from the shore of the lough back to the summits of the surrounding hills, half concealed by the haze of early morning, the little hamlet of Moville close by, the larger dwellings seen at long intervals in the more picturesque spots, and an old ivy-covered, ruined castle, which we had just passed, formed, altogether, a picture beautiful intrinsically, and one which, to eyes which had been, for nearly two weeks, only able to contemplate an unvaried expanse of rolling waves, appeared a second Eden.

The steerage passengers were nearly all landed here, and the ship was soon headed seaward again. As the northern coast of Ireland was rounded, we had an opportunity to see that singular basaltic formation,

THE GIANT'S CAUSEWAY,

where 40,000 columns are packed closely together, forming the precipitous boundary of the Irish coast of Antrim. Isolated columns stood here and there, like colossal sentinels. At one point, a vast mass stood by itself at some distance from the face of the Causeway, with which it was connected by a bridge of ropes—a rude suspension bridge which has been thrown across the fearful looking gulf by some bold and skillful fisherman. It is a most interesting specimen of early engineering, for, like the rope bridges seen in South America and in China, this construction antedates considerably the days of Roebling.

THE CLYDE.

From this point all the way around the coast, across the North Channel, and up the Firth and the river Clyde, our eyes were feasting upon ever changing but always beautiful scenes. The lofty headlands of the Mull of Cantire, the hills of Arran and of Holy Island, the romantic bays and the narrow mouthed lochs of the Scotch coast, afford uninterrupted enjoyment to the lover of the beautiful in nature. At one point, we obtained a fine view of the summit of Ben Lomond, enveloped in a soft purple haze, yet brought out into relief by a background of clouds illuminated by the bright golden rays of the setting sun. We took a pilot at Greenock, and, as we steamed slowly by the wharves of that old town—the birth place of James Watt—we counted nearly twenty large iron steamers, completed or in process of construction.

Just below, we had passed a great steamer, the City of Chester, next to the Great Eastern the largest in the world; and, not far above, we saw the monument erected to Henry Bell, who sixty years ago built, here on the Clyde, the first successful steam vessel which ever ran in British waters. She was a little craft of about 60 tuns burden; the City of Chester probably has a displacement of seven or eight thousand tuns. The latter is nearly 600 feet long.

Nothing could be more appropriate than that the scene of the birth and of the first great work of James Watt, and that of the earliest triumphs of Bell, should be known, to-day, as the spot where the greatest masterpieces of human constructive talent are wrought.

Just above Greenock is the famous castle of Dumbarton, where Wallace was for a time imprisoned. This, then impregnable, stronghold is built upon an enormous, steep sided, rock, which stands 500 feet high, all by itself upon the shore, and, projecting out into the tide, is a most strikingly picturesque object. Behind it is the village of Dumbarton, where the Messrs. Denny are building some fine iron ships.

The scenery becomes less striking as we go up the river; and the beautiful environed fishing villages, and the pleasant watering places, seen so frequently on the shores of the Firth, give place to isolated farm houses or elegant country seats, with smooth lawns and grounds elegantly laid out, as we progress towards Glasgow.

As Glasgow is approached, the whole work done by the "Clyde Trust" in deepening the river, reclaiming the formerly overflowed meadows which border it, and in building substantial embankments, is observed by every one.

GLASGOW.

The prosperity of a city is seldom dependent upon local natural advantages alone; and the proximity of the iron and coal producing districts of Scotland, her experience in manufacturing, and the advantages arising from the fact that Glasgow is the birthplace of British marine engineering, could hardly have given that city her present position as the second in population (and the first in the realm in several branches of manufactures) had not her people, long ago, had sufficient foresight and energy to expend enormous sums in the improvement of the water approaches to the city.

Two hundred years ago the port of Glasgow was on the Ayrshire coast. To-day ships drawing twenty-three feet of water have reached the city wharves.

The work of maintaining and improving the ship channel below Glasgow is, by act of Parliament, placed in the hands of the Clyde Trust Company, which is controlled by Glasgow capital. This company have expended, in this work, about *twenty-eight millions* of dollars, and are still at work on their great scheme. They are permitted to levy a moderate tunnage tax, and the value of their labors, to the city, may be inferred from the increase of their income from this source. They received, in 1840, $286,487; in 1860, $443,938; and, in 1870, $493,346.

They are employing a number of immense dredging machines, and are removing about one million of tuns from the channel, annually. The registered tunnage of vessels arriving and departing annually has now exceeded the enormous amount of 5,000,000 tuns.

The wharf at which we landed was reached, after passing the great shipyards from which a large portion of all the iron vessels in the world are sent out, and after slowly threading the narrow channel left between the long lines of steamers and sailing vessels which were closely packed on each side, sometimes three or four abreast. We ran the gauntlet of custom officials and were glad to find ourselves comfortably settled in our hotel, in the small hours "ayont the twal."

We had hoped to be able to make a leisurely tour *Weltausstellung*-ward, visiting some important manufacturing establishments in Great Britain and France, and some well known technical schools *en route*, but, among the letters awaiting us, at the office of our consul, was an urgent request to appear at headquarters in Vienna during the following week. Much can be done in even the limited time allowed, if it is well employed, and our programme includes a day in Glasgow, a day in London, one in Paris and one in Munich, and at least three nights on the rail. R. H. T.

Cultivation of Lobsters.

An interesting account of some recent experiments in the breeding of lobsters is presented by a correspondent of the Boston *Journal of Commerce*, the locality of the trial being on the New England sea coast, which is celebrated for lobster fruitfulness, even if its shores are sandy. It appears that the lobster conservatory consists of an inlet from the sea which has been enclosed by an embankment. The space enclosed contains thirty acres, and gates are provided to permit the tidal movement of the water.

"Last summer some 40,000 lobsters, of every age and condition, were let loose in the pond. Many of them were in the soft shell state, and many were unsaleable on account of a lost claw, or other mutilation. Food, in the shape of refuse from the fish market, was freely supplied to them; and a gate was put up at the entrance to prevent their escape nto the sea.

When the ice had covered the pond, holes were cut and lobster traps were put down. Good, sizeable hard shell lobsters were at once caught, and two things were proved: First, the water was deep and pure enough to keep the fish alive, and secondly, the fish were healthy, for they had taken their hardened shells, in the usual manner, and new claws had grown in the place of those lost. In the spring, eels, perch and a great many other kinds of fish were taken from the pond in liberal quantities; and now that the spawning season is well advanced, the farm has reached its final and most critical stage. Some 15,000 good, marketable lobsters have been taken out and sold. Everything is favorable so far.

The experiment is a very important one. If it succeeds it will introduce an entirely new system of lobster fishing, and do much to prevent the destruction of the natural supply. Nor is this all: for the same pond can be made to yield perch, flounders, eels, smelts, and other fish in great quantities, at no additional expense.

Mr. J. H. Johnston, of the Great Western Gun Works, 179 Smithfield street, Pittsburgh, Pa., whose advertisement has been published in this paper for some time past, requests us to state that the minimum price of his double barrel shot guns should have been published at $8 instead of $3. We take this method of calling attention to the mistake, and would direct attention to his advertisement on another page.

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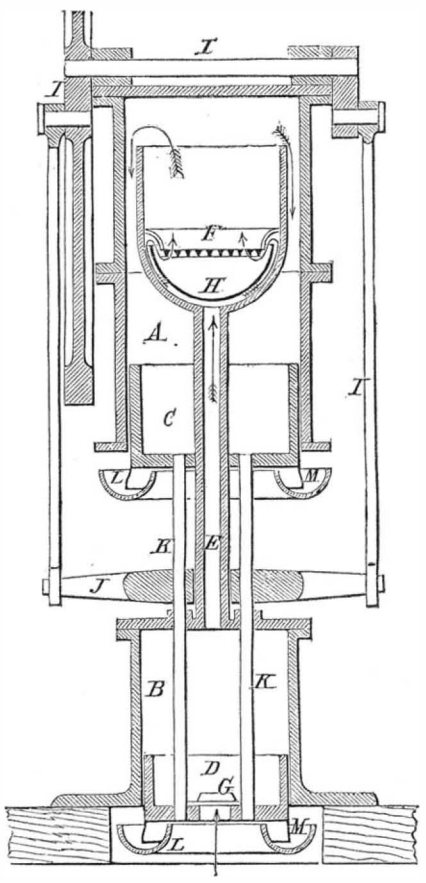
Correspondence.

The Hot Air Engine.

To the Editor of the Scientific American:

I have another modification of the hot air engine to suggest. We have had several of these engines of the Ericsson and Roper stamp, mostly of the latter, in use in this vicinity for a sufficient length of time to test their merits pretty thoroughly; and I am convinced that, when properly managed and not pressed beyond their normal capacity, they are both efficient and economical as a moderate power, say from one to four horse; but I believe that their efficiency may be largely increased by a slight change in the arrangement of their parts. The chief trouble is caused by the action of excessive heat upon their active parts; this is especially the trouble when working up to their full capacity.

In a previous letter (on page 373 of your volume XXVIII), I suggested that the trouble from over heat might be avoided, partially at least, by placing the cylinder directly below instead of one side of or above the fire; this modification and some additional ones are clearly delineated in the annexed illustration. A represents the hot air cylinder; C, its piston; B, the cold air or supply cylinder; D, its piston; F, the fire box and grate; H, the ash pan. The pistons are perma nently connected together by the rods, K, and to these rods the cross arm, J, is permanently fixed. This arm transmits motion from the pistons to the parts marked I, namely, the connecting rods, crank, fly wheel, and shaft, as shown.



At each downward stroke of the pistons, the valve, G opens and admits cold air into the supply cylinder, B; and a each upward stroke, the cold air is forced through the pas sage, E, into the ash pan, H, and through the grate and fire F, thence over the edge of the fire box, down the annular space between the fire box and the wall of the hot air chamber to the cylinder, A, forcing the piston, C, downward by its expansive power; thus the operation continues while the fire lasts.

The direction of the air is clearly indicated by the arrows. It will be seen that this arrangement admits of the cylinders being open at the bottom, so that a self-lubricating device may be attached; it consists of an elastic ring, M, attached to the piston, and a circular reservoir of oil or water into which the ring dips at each downward stroke of the piston. This self-oiling of the piston, without waste of oil, is certainly a valuable feature of this arrangement, and the constant flow of cold air through the center of the hot air piston and cylinder, up the passage, E, will tend to keep down the temperature in the cylinder below a troublesome point.

The minor details, such as the exhaust valve, fuel door, regulator, etc., I have not given in the illustration, but I would recommend placing the exhaust valve at the highest point in the hot air chamber; the powerful upward tendency of heated air suggests this idea. I would also suggest making the exhaust valve and passage at least twice as large as they usually are; this idea is suggested by the low tension of hot air as compared with that of steam, and its consequent more sluggish motion.

The desire of the operators of these engines, to get more work out of them than they were designed to supply, seems to be the cause of the chief injury or trouble; and I have no doubt that there will be such a modification in the proportion and disposition of their parts as to greatly mitigate this danger from overheat, and also to largely increase their efficiency.

F. G. WOODWARD.

REMARKS BY THE EDITOR:—Our correspondent's plans for the improvement of the hot air engine seem to be in the right direction, and we shall be glad to hear from him again. The minor details he alludes to are of great importance. We shall be pleased to see his plan for feeding the furnace without stopping the engine, if he has worked up that detail.

The Rights of Inventors.

To the Editor of the Scientific American:

Pardon me if I take exception to your views as expressed regarding patents, in your last issue, when replying to the queries of the Hon. Hamilton Fish; but the ground taken seems so unjust to the large body of discoverers and inventors that I cannot refrain from at least expressing my opinion.

I think that the productions of a man's brains are just as much his property as that acquired by the labor of his hands. A patent is a title to that property, given him by the government as *prima facie* evidence that he is the owner, and the same laws which govern the rights of property should apply to a patent. If, as you say, "the invention by an individual of a new device by which his fellow men are benefitted does not entitle him, by any process of natural right or natural justice, to be a monopolist over his fellows, in respect to such article," and, "on the contrary, every man in every community is bound by the strongest natural obligations freely to contribute his best powers of mind and body to promote the common welfare," it is just as reasonable to say that every dollar that he earns shall be used for the benefit of his fellow men.

Acquisitions of any kind are at the expense of labor, force, vitality, or, what is regarded as their equivalent—money, and if I have passed the best days of my life in patient study, self denials, disappointments, misgivings and failures to wrest from the secret forces of Nature that which any one else might have gained by the same means—by what right, natural, legal, moral or social, does that process, when I have acquired it, belong to any but myself, any more than the bread that I have earned by the sweat of my brow? I simply ask the question. I cannot answer it.

J. E. WILSON.

REMARKS BY THE EDITOR.—Our correspondent forgets that his person and all his possessions belong to the State. If by years of toil and study he has acquired property, the State may seize it: may take his body and compel him to service: may imprison him, or even destroy his life. Our correspondent lives in the constant experience of these facts. When the State wants money, it helps itself from our correspondent's earnings; when it wants a new road, it takes his lands, pulls down his house, and drives him away, *nolens volens*. In a community, all private interests and rights are ignored. Were it otherwise organized, society could not exist.

Let us follow out our correspondent's theory and suppose that he were the first inventor of bread. The exclusive right to make, use and sell bread would be his by natural right, transmissible to his heirs and assigns for ever, if we understand our correspondent; and all the world must starve if he or they should so will. Such reasoning is manifestly untenable.

While an individual may labor and enjoy the fruits of his labor, he cannot be permitted to interfere with others who do the same thing, unless by their consent.

Now, a patent is an interference with the rights of others; but the people consent to it temporarily, on the ground of expediency. The State wishes to encourage individuals to invent. The promise of a patent tempts men to do so. The new arts and inventions thus discovered are in due time seized by the State and become public property. A patent is simply a reward offered for a special purpose. It is a mere baited hook for the catching of inventions for the sole benefit and use of the people.

Water as Fuel.

To the Editor of the Scientific American:

I observe, in your issue of April 5, some observations on this subject, to which, as the data are not fully described in the *Alta*, your editorial remarks hardly apply. In addition to the *Alta's* description, I may mention that the boiler is a small one (working under only 40 lbs. pressure), from which the steam passes through a superheater, which is a pipe bent several times at right angles to itself, and at each angle there is a flat disk against which the steam impinges. This is said to have the effect of decomposing or breaking up the steam, pretty much on the same principle as some atomizers for inhalation were arranged. The steam, then, is directed against a jet of any hydrocarbon, which is claimed to unite with the oxygen of the water, leaving the hydrogen to be consumed by contact with the oxygen of the atmosphere, thus forming a veritable oxyhydrogen blast. Of course, a fire has to be lit under the boiler to start the steam, and thus the inertia is overcome; but, the boiler and superheater being situated within the influence of the oxyhydrogen flame, when steam sufficient is generated to start the oxyhydrogen blast, no more fuel is required to keep up the steam in the boiler.

I am no believer in the slightest approach to perpetual motion, and I must say this looks very like it, with the exception of first overcoming the inertia by other means than those self-contained. I have visited this furnace several times to judge for myself; and, for the size of it, I must say it is the most powerful flame I have ever seen, and its effects are most satisfactory in smelting refractory ores. It is called here, I think, the Stevens patent.

If, as is claimed, steam can be decomposed and broken up, or, rather, broken up and decomposed, by striking, under pressure and heat, against angular projections, leaving the oxygen to combine with a hydrocarbon, and leaving the remaining hydrogen to unite with the oxygen of the air, then the invention is based upon scientific laws and actually works in practice. But if that claim is fallacious, then there must be some hitch which I have failed to detect, as the boot top experiment cannot be gainsaid; but if the thing is not based upon scientific principles, I should like to know where the hitch comes in.

I am inclined to think that the steam is volatilized, if I may use the expression, by repeated breaking up or division of its molecules, as water or perfume is broken into spray; and in that state, the union of the oxygen with the hydrocarbon is facilitated.

I have no interest in the matter other than as an inquirer and student of natural philosophy.

Oakland, Cal. A. W. T.

REMARKS BY THE EDITOR.—We will allow that the steam, by striking against the disks and passing through the superheater, becomes so intensely heated that it is decomposed; but, even in this case, there is no "hitch," and our remarks in our journal of April 5 apply with full force to this and all other cases in which water is used as fuel. The "hitch," in our correspondent's conception of the process, appears to be that he considers the steam to have acquired so much power, after being decomposed, that it is able to form the same quantity of steam, and have a large reserve of heat remaining. This would be true perpetual motion, except that the process has to be started by the use of coal. Now it must be evident that, if the steam cannot commence its decomposition without fuel, neither can it continue this disintegration without a similar amount. A very simple experiment would prove the truth of this proposition. If the decomposed steam has enough heat energy to enable it to decompose a similar amount of steam, and leave something over, we have only to cut off the supply of hydrocarbon, and the process will go on, with somewhat diminished intensity, to be sure, but still quite vigorously. If this experiment were to be tried, there would be a "hitch" indeed.

The Proposed Transatlantic Balloon Voyage.

To the Editor of the Scientific American:

In regard to the feasibility of a transatlantic trip by means of a balloon, my impression is that Professor Wise understands himself and his subject infinitely better than do the public; and it is extremely probable that his success is more than possible. The fact is well known that currents of air, moving in different directions, form the aerial strata around the earth; and all that would be needed by the navigator, in order to make balloon voyaging a perfect science, would be to understand these movements. These can be determined by observation and experiment; and it may be, in future years, that we shall be as familiar with these air strata as the geologist is now with those of the rocks, or the navigator with the currents of the ocean. Fixed laws govern all matter, and we are all children in the great school of Nature, learning these laws. Where is the great danger and difficulty about balloon navigation when these currents are known? It will be a mode of navigation safer and far speedier than the ship or steamer. The ship is confined to one stratum of the atmosphere, where may prevail a terrific tornado in which nothing will live, while the balloon may rise or fall out of danger when navigators of experience control her. A well constructed balloon will be as safe as either the ship or steamer. There is no more danger of the collapse of a balloon than of a ship springing a leak or a steam boiler exploding; besides, the balloon may be divided into compartments of air chambers to insure greater safety. I remember reading a year or two since an article, written, I think, by Chancellor Livingston in 1812, in reference to the feasibility of steam carriage by rail, in which the Chancellor ridicules the idea as preposterous, and states why the project will not succeed. His reasons why are very laughable to us now, who see their fallacy. All inventions of value to the world spring not forth as Minervas, but have their babyhood, youth, and manhood. I truly hope Professor Wise may be encouraged in his grand enterprise.

New York city. C. ROWLAND.

The Meteors of November 14 and 27.

To the Editor of the Scientific American:

The meteoric display whose present epoch is November 14 occurs later in the month at each successive return. In other words, its node progresses on the ecliptic, so that an interval of 33 years corresponds to an advance of one day in the date of the shower. In 1932, therefore, the periodic fall of stars will occur on the 16th of the month. On the other hand, the node of the Biela meteors has a retrograde motion. The latest showers from this source were those of November 29, 1850, and November 24 to 27, 1872. At the same rate of motion, the nodes of the two rings will meet about November 16 or 17, 1932. As these meteor clouds move in opposite directions, the double shower at that time will probably be one of unusual interest.

Bloomington, Ind. DANIEL KIRKWOOD.

Fruit Safes.

Fruit may be preserved in excellent condition the year round, provided the temperature be low and dry. It is becoming now to provide fruit safes for this purpose, and in some localities the neighbors unite to construct a suitable building, in which each subscriber is entitled a fixed share of the storage room.

Mr. Christopher Shearer, a fruit farmer near Reading, Pa., has a fruit safe fifty-five feet square, which holds, when filled, about one hundred and forty cartloads of ice and four thousand bushels of fruit. Last fall Mr. Shearer placed in it one thousand seven hundred bushels of apples, four hundred and fifty bushels of Bartlett and fifty bushels of Lawrence pears. Some of the apples are still there and as solid as when they were taken from the trees.

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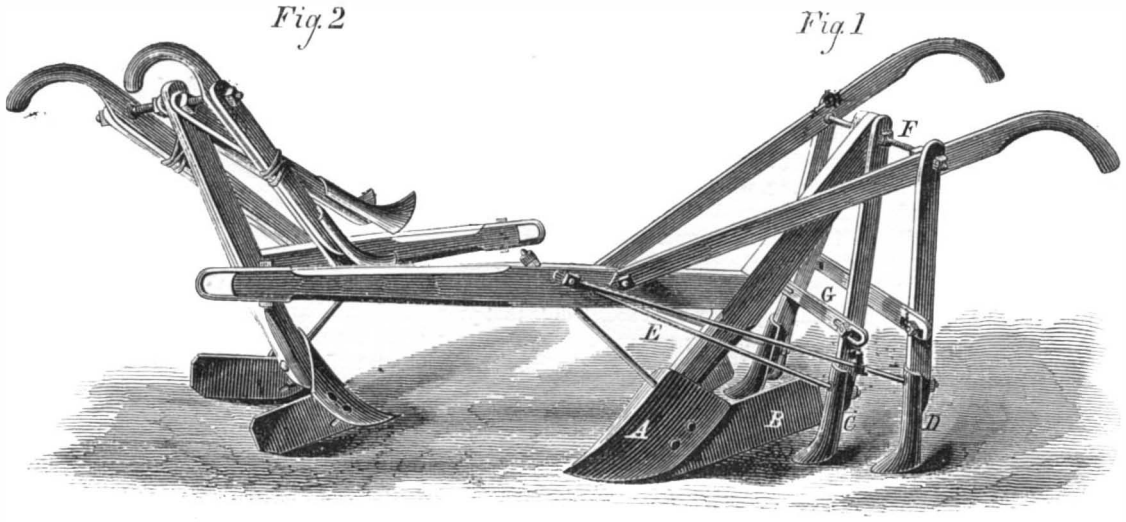
IMPROVED CULTIVATOR.

Our engraving illustrates a new form of cultivator, which is constructed so as to cultivate or loosen the earth between two rows of growing crops of corn, tobacco, sugar cane, cotton, or other products. The special improvement in the machine consists in the arrangement, in connection with a single shovel plow, of a series of hoes arranged in rear of the former and adjustably secured to the plow.

The standard, Fig. 1, projects above as well as below the beam, and carries on its lower end the shovel, A, upon the back of which, and at either side, are pivoted wings, B. These are secured by bolts and nuts, as shown, and may be adjusted so as to operate to the best advantage under varying conditions of soil. In rear of the shovel are four hoes, arranged in pairs, C C and D D, and connected by the tie rods, E, to the beam. The rods to which these hoes are attached extend upwards, and are hung upon a horizontal bar, F, which passes through the handles of the standard. This rod is preferably screw threaded, and provided with the requisite number of nuts to hold the different parts in their proper relative positions. The pair of hoes, C C, are held apart by a bar, G, and the other hoes, D D, are similarly separated by a like device. These bars are clamped to the hoes by bolts and nuts, and are at those points provided either with a series of notches or with longitudinal slots so that the blades may be spread apart as circumstances may require. The hoes are turned up on one side so that by changing them from one side of the plow to the other, they may be made to throw the earth up to or away from the row of growing plants.



KROGH'S FARM CULTIVATOR.

When it is desirable to use the single shovel plow without the hoes, the latter are disconnected from the tie rods, D, which, together with the hoes, D D, are tied up or hung upon the handles, as in Fig. 2, while the hoes, C C, are swung over and carried on top of the beam. Either pair of hoes may be thus disconnected while the other pair remain in operating position.

Patented December 10, 1872. For further particulars address the inventors, Messrs. C. and P. G. Krogh, Kroghville, Jefferson county, Wis.

AN IMPROVED HORSE COLLAR BRACE.

The weakest part of the ordinary horse collar is at the under side or throat, as it is at this point that the strain is principally applied. As a result, and especially in light collars, the article becomes worn out or breaks in this locality much sooner than in other portions. To obviate this difficulty, Dr. Edward Batwell, of Ypsilanti, Michigan, has recently patented, April 15, 1873, a metal plate which extends up some distance, and thus prevents the collar from closing on the horse's shoulder. The form of the device, which may be made of any suitable metal, together with its mode of application are readily understood from the annexed illustrations.

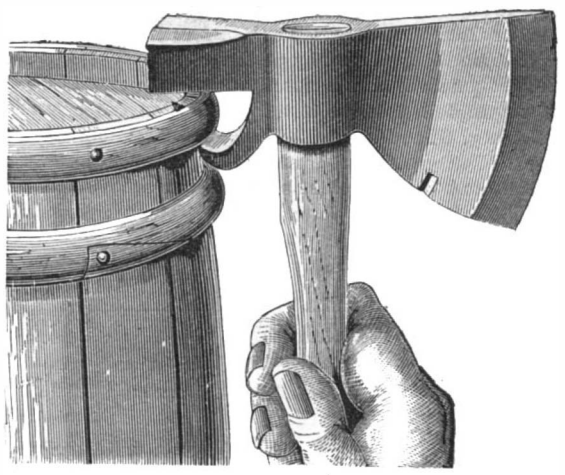
Dr. Batwell states that the invention has been fully tested, in preventing pressure and in retaining the collar in good shape, for the past two years, and that by its use he has been enabled to employ collars otherwise entirely worthless, from being broken or worn out at the throat. For further particulars regarding sale, rights, etc., address the inventor as above.

John Stray.

John Stray is employed as an engineer in a factory at Jersey City, N. J. He is a short, thick set man of fifty years or so, with a frosted beard, and does not look as if anything very serious had ever happened to him. But he is the hero of a patriotic exploit that will live in the memories of his fellow citizens. John Stray was a private in the First New York Volunteer Engineers, at Morris Island, Charleston, S. C., during the siege of 1863. An important gun—a 200 Parrott—had been spiked by the enemy, who were then enabled to occupy rifle pits very near the gun, and prevent its use by shooting down whoever ventured to attempt the removal of the spike. Stray was known to be a good mechanic, and at last yielded to the request of the commanding general to undertake the desperate job. He straddled the gun, and for fifteen minutes drilled away amid a shower of bullets, then hitched on the primer and lanyards and dropped to the ground. The enemy thought they had hit him and sent up an exulting howl, but the flash and roar of the great gun and the showering of grape through their ranks soon showed them their mistake. Those who could do so ran for their lives, but many were killed. It was found that twenty-two bullets had struck the gun while John Stray was working his drill.

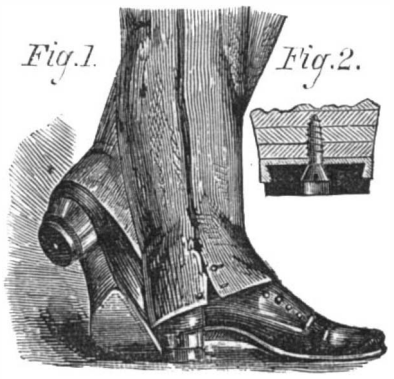
NOVEL CLAW HATCHET.

The object of this handy little device is so clearly indicated in our illustration that little description is required. It consists, simply, in a claw, made upon the hammer end of an ordinary hatchet, which serves to grasp the top hoop of a barrel. By the aid of the handle as a lever and the hatchet head as a fulcrum, the hoop can be quickly removed uninjured, thus allowing the head of the barrel to be easily taken out. Patented Nov. 12, 1872, by Mr. D. E. Weaver, of Cheviot, Ohio.



NEW HEEL PLATE FOR BOOTS AND SHOES.

Mr. Gideon B. Massey, of New York city, is the inventor of this device, the object of which is to prevent the unequal wearing out of boot heels and their consequent unsightly twisting over to one side. A disk of rubber is arranged of a diameter to fit within a flange on a metal plate and to project below the same, forming a wearing surface of the heel. This is attached by a fastening screw and a conical metal washer formed to fit the under side of the screw head. The latter is forced into the disk, which it pushes into the dovetail flange by which it is securely held. As the wearer turns upon his heel, the plate will partially revolve and change its position, so that the heel will wear square and the foot be thrown flat upon the ground. The use of india rubber or other elastic material prevents slipping on the ice, and adds to the gracefulness of the step, while carpets are not injured by projecting nails or sharp angles. Patented September 17, 1872.



Progress of Astronomy in the United States.

Mr. Richard A. Proctor, the distinguished British astronomer, bears the following testimony to the progress and results of astronomical science in this country:

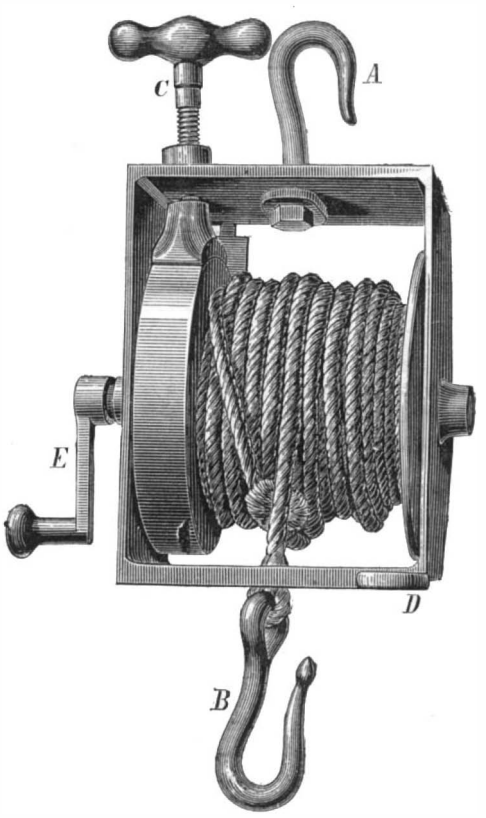
"The American arrangements for extending government aid to astronomy seem to me to afford a model which might be copied with advantage on this side of the Atlantic. We see their physical observatories attached to other government establishments, to universities, and so on. Their professors of astronomy are not only real working astronomers, but skillful mathematicians (for the most part university men) and men of admirable zeal in the cause of science. I have been struck with the abundance, I had almost said the superabundance, of labor which has been bestowed on work the record of which has recently reached me from America. Thus, in the mathematical investigations of the coming transits of Venus, a problem of difficulty has but to be suggested, to be at once attacked and solved to the utmost limits of exactness. The pictures of solar phenomena, spots, faculæ, and prominences, are the most striking and beautiful I have yet seen. Their lunar pictures are remarkable for artistic beauty, as well as scientific value, and, altogether, their work, as I have said, is a model for our astronomers."

A NEW FIRE ESCAPE.

Our engraving represents a new portable fire escape, by means of which, it is claimed, a person can lower himself with ease and safety from the windows of a burning building, or, if necessary, may be let down by some one within the edifice.

The apparatus is attached by the hook, A, to a suitable clamp, not shown, which is readily fastened to the window sill or casing. To the lower hook, B, is hung a sling seat in which the descending person is supported. Thus arranged, the device is operated by the individual within the building, who, by means of the screw, C, which presses a chock against the revolving disk attached to the barrel on which the rope is wound, governs the descent, causing the same to be fast or slow at will.

In case of a person lowering himself, the machine is inverted and suspended by the hook, B, to the clamp, the sling being hung to the other hook. The operator then grasps the handle, D, with the left hand, and the screw, C, with the right hand, and thus regulates his downward movement. By tightening the screw, a slow descent may be effected by means of the crank, E. The invention is stated to be cheap, efficient, and not liable to get out of order. For further particulars regarding agencies, sale, etc., address the patentees, Messrs. Merritt & Sweetser, P. O. Box 2,643, North Bridgwater, Mass.



PHENANTRENE.—This name has been given to a new hydrocarbon obtained from crude anthracene. It contains carbon and hydrogen in the same proportions as the material from which it is derived.

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An Ocean Race of Seventeen Thousand Miles.

An ocean race between an American and an English clipper ship has just been heard from. The American clipper-built ship Young America and the English La Escocesa sailed from San Francisco for Liverpool on the 27th February last, laden with wheat. Distance 17,350 miles. The Young America made the passage in 106 days, and her British antagonist in 117 days. About $20,000 was wagered in San Francisco on the result. The running time for making the same distance by our fastest Atlantic steamers, without stoppage for coaling, would be 58 days.

Collecting Wild Animals for the English Market.

In London there are one or two concerns which make it a business to collect wild animals, in India and in other countries, which are brought to the English metropolis and kept in stock until sold to zoölogical gardens and menagerie proprietors in other parts of the world. From this source, Barnum and others recruit their exhibition stock. In a recent number of *Land and Water*, it is stated on the authority of a Singapore paper that: "For some time past an emissary from Mr. Jamrach, the celebrated proprietor of menageries, has been staying in Singapore. The business which brought him here is to purchase specimens of the *ferœ naturæ* indigenous to the Malay Peninsula and surrounding countries. The result of his exertions may be seen at the yard attached to the *Hotel de la Paix*, where are assembled the animals and birds obtained up to the present time. These of themselves form a curious and very interesting collection, that has attracted a number of visitors. The gentleman in charge most courteously exhibits the creatures to those desirous of seeing them, and the amusement to be derived from a visit more than repays the trouble involved, as will be evident from the following list: Four large male and female tapirs from Malacca, two cassowaries from Macassar, three Victoria crowned pigeons from the Celebes, two orang outangs, two black parrots, a black panther, a young female elephant, a bear from Borneo, and a pair of Borneo fire back pheasants. Of the above, the panther, which is a very snarling, ferocious looking customer, and the elephant were purchased from H. H. the Maharajah of Johore. Young Bruin is comical looking, with already a tendency to practical joking. A short while ago, he slipped his collar, and, getting into a house where were some young children, evinced his playful tendencies by a desire to rub noses with them. The timid owner of the house ran for the two revolvers he keeps beneath his pillow, but before he had time to uncase them, Master Bear's keeper came up, and rescued his *protégé* from impending destruction. The little creature looks as harmless and innocent as a puppy. We hear that these animals, with a rhinoceros or two expected next week, will be shipped for England by the next steamer of the Ocean Steamship Company; and in addition to them, Mr. Jamrach's agent has entered into a contract with two local Nimrods (Messrs. Fernandez Brothers) to hunt and buy up, within the next six months, eight live specimens of each of the following animals, namely, rhinoceri, tapirs, tigers, and black panthers, and sixteen male and female Argus pheasants. The hunters for the rhinoceri have a number of pits dug for entrapping these animals; and if they fall in, that ardent naturalist, Mr. Frank Buckland, will probably ere long have the pleasure of chronicling the birth of another cockney rhinoceros.'"

Concrete Chimneys.

The first chimney ever built of concrete, and without scaffolding, has, according to the *Engineer*, been constructed at the Chain Cable and Anchor Testing Works, at Sunderland, England. The structure at the base is 7 feet 6 inches by 7 feet, and is carried up square to a hight of 22 feet 3 inches, up to which point no especial novelty in its construction is presented. The corners, however, are gradually cut away; and at the hight of 24 feet above the surface, the octagonal form of the tapering portion of the chimney begins. This part of the work was molded as follows: Panels three feet in hight and made of ¾ inch boards were hinged together at their outer edges in such a manner that, if the lines of the inner edges were produced, they, the lines, would come into one point at half the hight of this section of the chimney. These panels on the interior and exterior of the chimney formed shells, between which the concrete was packed. To fill up the intermediate space between the inner edges of the panels, wedges were introduced, which, as the concrete set, were gradually reduced in order to allow for the decrease in size. Stud bolts connected the wedges with uprights of the frame, and this reduction, made as above, was just sufficient to take off the holes through which the bolts passed.

When the shaft had been erected half its hight, the panels were reduced sufficiently to admit a second set of wedges of exactly the same dimensions as those first introduced, bringing the inner edges of the panels (produced as before) to one point at the center of the top of the chimney; that is to say, in a manner similar to that in which, at their original dimensions, they had been brought together at half the hight. The uprights, to which the panels were secured, were 6 feet in length; and as the latter were but 3 feet, the uprights had a continual hold of 3 feet on the completed work, thus insuring regularity of line.

The cement used was one part Portland cement to eight of gravel, and at one time these parts were increased to one to five. The chimney, when completed, was stuccoed with cement, and drawn in courses to imitate stone.

ROBERT WILHELM BUNSEN.

The labors of the savant whose career we are about to portray belong essentially to researches which are not exclusively chemical, or exclusively physical, but appertain to both, and have added largely to that branch of science known as physical chemistry. As Berzelius will always live in our memory as the founder of the electro-chemical system, Gerhardt as the discoverer of the theory of types, and Liebig as the originator of agricultural chemistry, so will Bunsen always be remembered as the one who has most contributed to the application of chemistry to physical inquiries. Like all men of great genius, the subject of our biographical notice was less occupied with the reinvestigation of phenomena and laws already known than with the exploration of new regions and the discovery of facts which, in themselves, indicated new scientific truths.

The discoveries which have done most to extend Bunsen's renown are those pertaining to spectrum analysis; but his name will always be recalled when we speak os the theories of periodical fountain springs, or of the phenomena of the absorption and combustion of gases, or of the chemical action of the different rays of the sun.

Robert Wilhelm Bunsen was born on March 31, 1811, in Göttingen, a town in Hanover, known by its famous university, in which his father occupied one of the chairs of languages. At the age of seventeen he entered the university of his native town, in order to pursue physical and chemical studies; and after having passed through all the grades, he took the degree of doctor in 1833. In 1836 he removed to Cassel, in order to fill the chair of chemistry at the polytechnic school of that city, which had been vacated by Wöhler. Two years later, Bunsen was elected professor of chemistry in Marburg; and, in 1851, he removed in the same capacity to Breslau. In 1852 he was nominated professor of chemistry in the university of Heidelberg, which position he still holds.

ROBERT WILHELM BUNSEN.

His earlier labors were devoted to researches on double cyanides, on the various kakodyl compounds, and, in connection with Schischkow, on the gases of detonating compounds. He also discovered in the freshly precipitated hydrate of oxide of iron an excellent antidote for arsenic. In the domain of physics, we see him engaged in determining the specific weight of various bodies, in studying the law of the absorption of gases, and the influence of pressure upon the solidification of liquids. We owe to him important contributions relative to the combustion and diffusion of gases, etc. Bunsen is the discoverer of the galvanic battery which bears his name, and which is now most commonly in use, also of that wonderful instrument known as Bunsen's burner. In the summer of 1846 he undertook, with Descloizeaux, a voyage to Iceland, in order to investigate the periodicity of the fountain springs, especially that of the great geyser. The result was that beautiful theory of the geyser eruptions which was afterward illustrated experimentally by Müller in Freiberg. In 1859, Bunsen first prepared the metal magnesium on a large scale, and showed that it yields the most brilliant artificial light known, and that its photo-chemical action was one thirty-sixth of that of solar light. In conjunction with Roscoe, he determined the chemical action of the various rays of the sun.

The researches of Bunsen on spectrum analysis date from the year 1860. Since that time he has contributed a large number of exhaustive memoirs on this subject to Poggendorff's *Annalen* and to the *Annalen der Chemie und Pharmacie*, besides many special volumes.

Herr Bunsen, although now in his sixty-second year, enjoys excellent health, and is still unceasing in the pursuit of his investigations. His style of lecturing is very happy, and has always attracted a large audience. His modesty is unsurpassed; and even when speaking in his lectures on spectrum analysis, he never mentions having contributed anything to this science, but speaks only of the discoveries of his friend Kirchhoff. Among his pupils are Roscoe and Tyndall, who, as is well known, are among the most ardent laborers in the field of science.—*Science Record* for 1873.

A New Scientific College.

A new institution, somewhat on the plan of the Stevens Institute, Hoboken, N. J., is soon to be built at Birmingham, Eng., founded on the generous endowments of Sir Josiah Mason. The institution is to be called "Josiah Mason's College," or "Josiah Mason's College for the Study of Practical Science." Regular systematic instruction is to be given in mathematics, abstract and applied physics, both mathematical and experimental; chemistry, theoretical, practical and applied; the natural sciences, especially geology and mineralogy, with their application to mines and metallurgy; botany, and zoölogy, with special application to manufactures; and physiology, with special reference to the laws of health. The English, French and German languages will also be taught. The trustees have power to include mechanics and architecture and all other subjects necessary to carry out the objects of the founder. Mere literary education and instruction are excluded, as well as all teaching of theology and subjects purely theological. No principal, professor, teacher, or other officer of the college is ever to be called upon to make any "declaration as to or submit to any test whatever of his religious or theological opinions," nor are these in any wise to be considered either as qualifications or disqualification for holding any office, fitness to give the instruction required being the sole and only test. Provision is also made for giving lectures and opening classes for popular or unsystematic instruction, at which the attendance shall be open to all persons, "without distinction of age, class, creed, race, or sex." The founder's object being to promote the prosperity of the manufactures and industry of the country, the college will be open to qualified persons of all classes who have to rely on science, art, or manufactures for a livelihood, "especially the more intelligent youth of the middle class." Provision is also made, when the funds permit it, to provide instruction for females as well as males.

Comparative Heat and Brilliancy of the Sun and the Moon.

The Earl of Rosse, in a recent lecture before the Royal Institution, gave some interesting information concerning the various experiments heretofore made to detect the heat of the moon, and then described his own efforts in this line, which are the latest that have been made known. By means of a specula-mirror, a thermo-pile, and a pair of reflecting galvanometers, made on Sir William Thomson's plan, such as are used for sending messages over the Atlantic cable, the Earl was enabled to demonstrate the presence of heat from the moon, but the temperature of the lunar surface still remains far from being determined. My calculations, he says, lead me to estimate the heat from the moon as the eighty thousandth part of that from the sun. Bouger's experiments give the brilliancy of the full moon as the 300,000th of that of the sun, Wollaston gives it as the 80,172d, Zöllner as from 618,000th to 619,000th, and Bond as the 470,980th. The maximum of the lunar heat appear to be a little before full moon; the unequal distribution of its mountains and plains, perhaps, goes to explain this phenomenon.

Aniline Black.

BY CH. LAUTH.

Aniline black, being necessarily absolutely insoluble, cannot be fixed like another coloring matter, but must be formed in the place which it is to occupy upon the fiber. To mix, with a salt of aniline, oxidizing agents capable of producing the black, and to wash the yarn in such a bath until the color is developed, is a method which does not yield good results, because the black, instead of fixing itself upon the fiber, remains suspended in the liquid.

The improvement consists in fixing on the fiber an insoluble oxidizing agent, and passing it subsequently into the solution of a salt of aniline.

The agents in question are the higher oxides of manganese, binoxide and chloride of lead, etc. Binoxide of manganese has especially attracted my attention. To get an intense black, it is necessary to mordant in chloride of manganese at 40° B., working the cotton in this bath for an hour, wring out well and, without rinsing, pass it into boiling soda lye, at 12° B., holding lime in suspension. Or the cotton may be first mordanted in a boiling manganese bath, and then passed through cold alkali. After the fixation of the oxide, the cotton is washed in much water, and passed into a lukewarm chloride of lime bath, regulating the proportion of this agent so that it may never be found in great excess, which might injure the fiber. It is best to add the chloride of lime, little by little, till the manganese bronze is sufficiently intense.

I have endeavored to modify the conditions of fixing the manganese. I mention a single remarkable result. A tissue, mordanted with manganese and placed in a chamber filled with ammoniacal gas, is found of a deep brown when taken out, the protoxide of manganese becoming readily peroxidized under these circumstances.

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Dyeing.—The yarns, charged with manganese and well washed to eliminate all uncombined matter, are steeped in a cold acid solution of aniline. The color is formed almost simultaneously. As soon as the bronze comes in contact with the aniline salt, the reaction takes place. The binoxide of manganese oxidizes the aniline, and the black formed takes the place of the metallic compound. The operation is finished in one or two minutes, but the yarn may be left an hour in the bath without inconvenience. The proportions to be employed vary according to the intensity of the black desired. When taken out of the dye bath, the cotton is well washed and passed into a boiling alkaline bath—soap or soda—to remove the last traces of acid and give the black its full beauty.

Bichromate of potash, at ¼ dram per quart, salts of copper, mercury, and chrome, and especially a mixture of chlorate of potash, a salt of copper, and sal ammoniac (¼ dram of each per quart), increases the intensity of the black. This treatment is applied after the washing subsequent to dyeing, and is carried on for half an hour at a boiling heat. It is followed by a second washing and by boiling in soap lyes. The process described gives fine, solid blacks; it is speedy, and does not injure the fiber.

Cotton cloth mordanted in this manner may be used to determine the comparative value of commercial anilines.—*Chemical News.*

THE NEW ELECTRIC LIGHT IN LONDON.

The drawing shows the contrivance devised by Mr. C. W. Cooke for the exhibition of the electric light from the Westminster clock tower. We copy from *Engineering*. *t* and *t'* (Fig. 2) are two large binding screws, which receive the terminals. Two metallic strips conduct the positive and the negative current respectively to *d* and *c*. From *c* the negative is led through the pivot of the revolving table to the right hand hinge, *h*; the positive at *d* is in connection with a circular strip of copper, which leads it to the left hand hinge. Finally the hinges communicate with two studs, *i i*, sunk into the upper surface of *p p'*. Two regulators, *l* and *l'* (Fig. 1), are fixed to a rectangular mahogany board, *r r*, free to slide on rollers from *p'* to *p*. Each lamp carries two copper strips, so bent that the portion to the right rubs against the studs, and thus insures good contact when the flat part reaches them. Fig. 2 shows the metallic pieces of lamp, *l*, pressing upon these disks, and thus admitting the current. When it becomes necessary to change the carbons, the table, *r r*, is pushed from *p'* to *p*. The second lamp, *l'*, comes into position; its copper strips are in contact with the underlying studs, and the current passes through its carbons. The time required to effect this change is scarcely appreciable. The light can be directed to any object by means of the screw, *f*, and the worm and worm wheel, *e*. The former, *f*, enables the operator to project the beam at any angle of depression lying between convenient limits; the latter, *e*, gives him an azimuthal motion of any amplitude required. Fig. 2 also shows a vertical section. The central piece is a lens which refracts into parallelism the rays, which differ in obliquity. The prismatic portions perform an important office in reflecting the rays which make large angles with the principal axis.

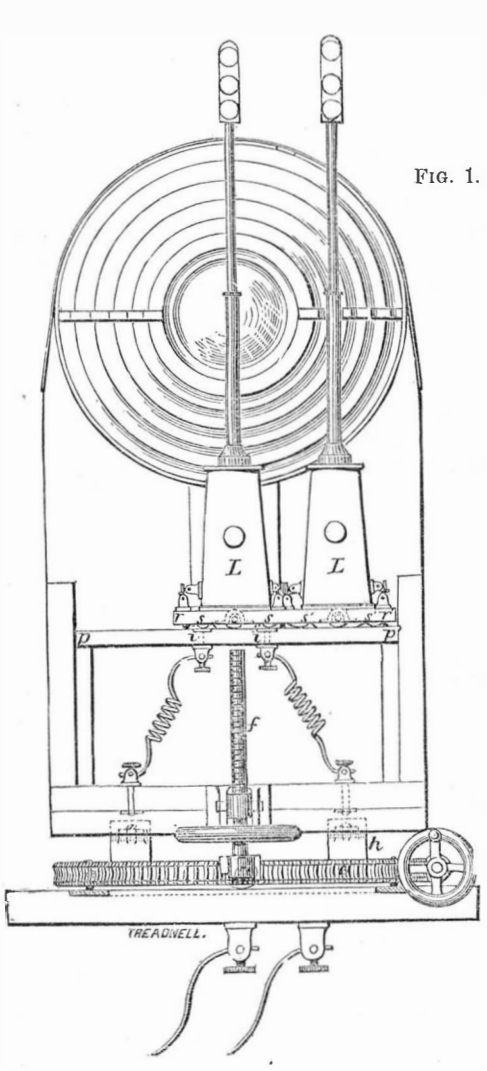

FIG. 1.

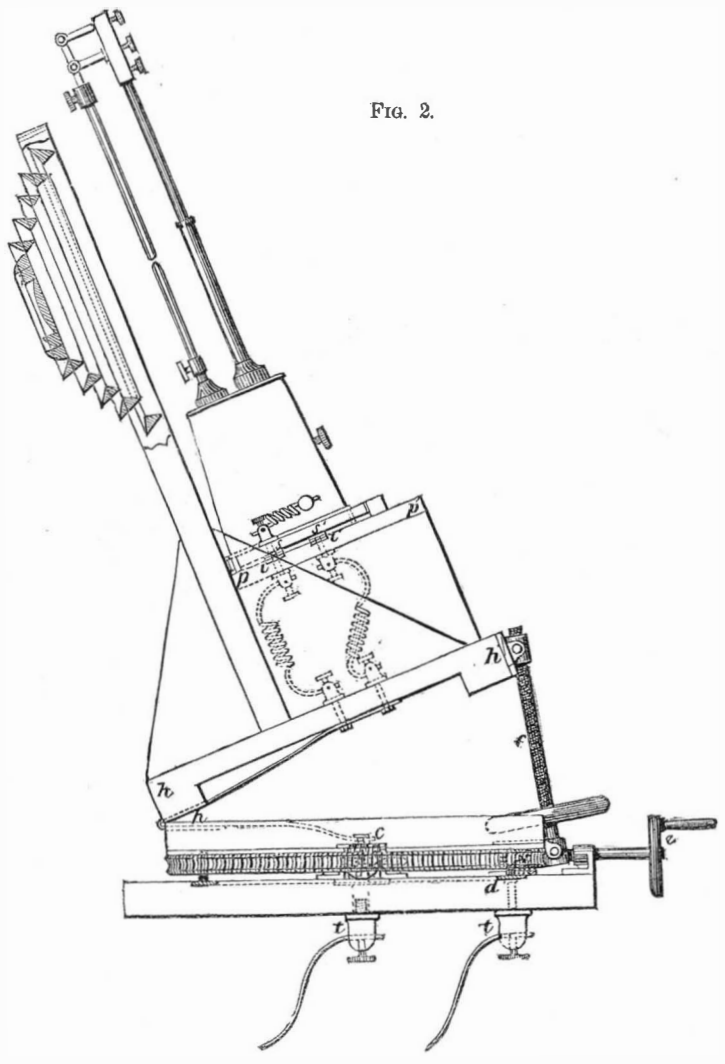

FIG. 2.

THE NEW ELECTRIC LIGHT IN LONDON.

John W. Foster.

John W. Foster, author of a new work on "Pre-historic Races of the United States," died at Chicago on the 29th ultimo, aged 58 years. He was well known for his scientific attainments, and has made important geological surveys for the government.

William Whiting.

We regret to announce the death, on June 29, of the Hon. William Whiting, member of Congress from Massachusetts, aged 60 years. In addition to his eminence as a patent lawyer, he occupied many important positions. From 1862 to 1865, he was solicitor of the War Department. He was the author of a work on "War Powers under the Constitution," which has passed through over forty editions.

The Crops.

During the past month the crops in some parts of the country, the South for example, have been injured by excessive rains, while in New England injury has been done by excessive dryness. In Plymouth county, Mass., great damages from fire in the woods have been experienced, about 60,000 acres having been burned over. Eight square miles were in flames at one time.

LIGHT AND LIFE.

The sanitary influence of light can scarcely be over-estimated. It is essential to the full development of nearly all animal and vegetable organisms. Plants when deprived of the influence of light become blanched and stunted in growth, the process of fixing the carbon in their tissues is arrested, a modification of the coloring principle takes place and they appear white instead of green. This is termed etiolation or blanching, and is applied by the gardener and horticulturist in the case of certain kinds of vegetables to improve their edible qualities.

A similar effect is produced upon animals by excluding them from the operation of light. Vitality is impaired and the development of the healthy bodily structure arrested. Naturalists tell us that in the course of healthy development the tadpole becomes a frog, but in the absence of light this transformation is prevented, and the tadpole remains a tadpole. From numerous experiments, both upon animals and vegetables, it has been proven that light is an important vital stimulant, favoring those complex changes in the organisms upon which healthy development depends. And though growth may proceed without it, there is both bodily and mental deterioration; a mental and moral etiolation, as well as a physical, occurs when the vital stimulus of light is withdrawn.

The inestimable importance of this agent upon life and health may be conclusively shown by comparing the robust forms and ruddy, bright, and happy faces of those who live among the green fields, and whose occupations necessitate regular exposure to sunlight, with the blanched, sallow countenances and emaciated, deformed bodies of those who dwell in dark and narrow lanes and alleys, and whose vocations deprive them of its health-giving and beneficial influence.

The sad effects of deprivation of sunlight are principally observed among those who are compelled to work in badly constructed shops and factories and the inhabitants of narrow streets, crowded alleys, confined courts, garrets and cellars where the light of the sun rarely penetrates. Similar consequences are observed in those who labor by night and sleep by day, as bakers and compositors connected with the daily press, whose occupation necessitates their employment during a greater part of the night.

The total exclusion of the sun's beams induces an impoverished and disordered state of the blood, favoring not only an arrest of physical and mental development, but also the generation of specific diseases. Under these circumstances the countenance becomes pallid, the membranes of the eye and lips bloodless, and the skin of a waxy color. Associated with these symptoms there is emaciation, muscular debility, and nervous excitability. The fibrin, albumen, and red blood cells become diminished in quantity, and the serum or watery portion of the blood increased, producing the disease known to physicians as anemia. The alteration of the physical composition of the blood and the enfeeblement of vital energy predisposes to the development of scrofula, chlorosis, rickets and consumption, diseases characterized by imperfect nutrition. Childhood being peculiarly a period of growth and development, it is especially important that children should have the fullest possible benefit of exposure to direct sunlight. Many of the diseases of the weak and emaciated children who are reared in narrow streets and crowded tenement houses of our large cities, are attributable to the deficiency of light and air. The sad effects of the absence of light are unfortunately not confined to those who, by the pressure of poverty, are compelled to dwell in localities and habitations where the solar rays vainly strive to enter. In many elegant mansions, whose occupants can command every luxury within the reach of wealth, we see the most ingenious means adopted for effectually excluding light, with the inevitable result of seriously impairing the health of the inmates. The nursery, where children necessarily spend so large a portion of their time, particularly during the colder seasons of the year, should be plentifully supplied with windows, and should be selected with special reference to the facility for securing the genial and cheering influence of the sun. Greenhouses are constructed so as to secure the greatest supply of light, and children require as much light as plants. Light is not only essential to the preservation of health, but is equally important in the treatment of diseases. There are a large number of disorders which may be greatly benefitted, if not cured, by free exposure to the light of the sun, while it certainly exerts an influence on the mind, favorable to recovery, which cannot be wholly explained by the mere cheerfulness and calmness it produces.

Florence Nightingale, in her admirable "Notes on Nursing," has pointed out the sanitary value of light to the sick. She says: "It is the unqualified result of all my experience with the sick that, second only to their need of fresh air, is their need of light,—that, after a close room, what hurts them most is a dark room. And that it is not only light but direct sunlight they want. I had rather have the power of carrying my patient about after the sun, according to the aspect of the rooms, if circumstances permit, than let him linger in a room where the sun is off. People think the effect is upon the spirits only. This is by no means the case. The sun is not only a painter but a sculptor. You admit that he does the photograph Without going into any scientific exposition, we must admit that light has a real and tangible effect upon the human body. But this is not all. Who has not observed the purifying effect of light, and especially of direct sun light, upon the air of a room? Here is an observation within everybody's experience. Go into a room where the shutters are always shut (in a sick room or a bed room the shutters should never be shut), and, though the room be uninhabited, though the air never has been polluted by the breathing of human beings, you will observe a close, musty smell of corrupt air, of air that is unpurified by the effects of the sun's rays. The mustiness of dark rooms and corners, indeed, is proverbial. The cheerfulness of a room, the usefulness of light in healing disease, is all important."

Dr. W. H. Hammond, in his lecture on hygiene, says: "In chlorosis, scrofula, phthisis, and in general every disease characterized by deficiency of vital power, light should not be debarred the patient. In convalescence from almost all diseases, it acts, unless too intense or too long continued, as a most healthful stimulant, both to the nervous and physical systems. The evil effects of keeping such invalids in obscurity are frequently very decidedly shown and cannot be too carefully guarded against by the physician. The delirium and weakness, by no means seldom met with in convalescents kept in darkness, disappear like magic when the rays of the sun are allowed to enter the chamber."

Sir David Brewster, in his eloquent address at the opening of the session of 1866–67 of the Royal Society, Edinburgh, uses the following language: "If the light of day contributes to the development of the human form and lends its aid to art and nature in the cure of disease, it becomes a personal and national duty to construct our dwelling houses, schools, workshops, factories, churches, villages, towns and cities upon such principles and in such styles of architecture as will allow the life-giving element to have the fullest and freest entrance, and to chase from every crypt, cell and corner the elements which have a vested interest in darkness."—*Thomas H. Helsby, M. D., in Popular Journal of Hygiene.*

PROGRESS OF THE HOOSAC TUNNEL DURING THE MONTH OF JUNE, 1873.—Headings advanced westward, 131 feet; eastward, 126 feet. Total advance during month, 257 feet. Length opened from east end, westward, 14,084 feet. Length opened from west end, eastward, 9,540 feet. Aggregate of lengths opened to July 1st, 23,624 feet. Length remaining to be opened July 1st, 1,407 feet, being 87 feet more than one quarter of a mile.

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TO EUROPE IN A BALLOON.

[Concluded from page 33.]

Atlantic may be accomplished with a very large balloon. This question he has discussed with much plausibility in his work on the subject, published in 1850; and having discovered, in his former aerial excursions, a current of air flowing to the east at a certain altitude, he has been led to believe a long voyage to the east could be successfully accomplished. To test this idea, a person was found, in Mr. Gager of Vermont, who had the enterprise and ability to furnish the necessary funds for the undertaking; and for this purpose the monster balloon Atlantic was built by Mr. La Mountain, at Lansingburgh, N. Y., and carried to St. Louis in order to make the experimental voyage from that city to this (New York), prior to making a grand atmospheric journey across the ocean to Europe. We will now describe the results of this attempt:

On the 1st inst., the balloon was inflated with sixty thousand feet of coal gas, the expansive force of which was capable of raising more than fifteen hundred pounds into the atmosphere. It had a common basket car secured to it and a very light and strong life boat slung below. Considerable ballast of sand bags was provided; a screw steering apparatus for changing the direction of the balloon, several philosophical instruments necessary for the voyage, plenty of provisions, and a bag of papers, letters, and small parcels from an express company to their office in this city, composed the freight. At twenty minutes past seven P. M., all things being ready, Mr. Wise ascended into the basket, and Messrs. La Mountain, Gager, and Hyde (the latter of the St. Louis *Republican*), took their places in the life boat. The signal was then given for the stay ropes to be cut, when the mighty mass shot up from St. Louis into the blue ether like a rocket, amid the plaudits of the multitude. Having ascended to an elevation where the thermometer fell to 42° and the barometer to 23°, a strong eastward current was met, and away they floated towards New York. At this time Mr. Wise, having been much exhausted with the preliminary duties, resolved to have a nap, and for this purpose he bade his companions below goodnight, rolled himself in his blanket and was soon fast asleep. Near midnight he was awakened through a peculiar incident. Mr. La Mountain, who had charge of the midnight navigation, discovered that they had ascended to a considerable elevation; and the gas being thus relieved from pressure, he hailed Mr. Wise to open the valve, as the balloon had become very tense and the gas was rushing from its neck with a loud noise. Having received no answer, he suspected that Mr. Wise was smothered in the gas, and olicited Mr. Gager to mount into the basket by a rope and ee what was the matter. This was done, and the veteran eronaut was found breathing spasmodically; but a good a shaking and the removal of the neck of the balloon from his face soon relieved him. Onward the balloon sped, after this, until daylight dawned, and at five o'clock next morning they were at the upper end of Lake Erie. After some consultation it was resolved to sail over the entire length of its waters, in order to test a notion entertained by some persons that there is a peculiar affinity between balloons and water, which draws the former towards the latter, and prevents them from remaining suspended above it any length of time. For some time they moved along only 590 feet above the lake; then, when near Buffalo, they rose higher, crossed Grand Island, and proceeded towards Lake Ontario. It was here resolved to land at Rochester and let out Messrs. Hyde and Gager, after which Messrs. Wise and La Mountain were to prosecute the voyage, hoping to reach Boston, knowing they were too far north now to reach New York. In order to carry out this conclusion, they gradually descended towards *terra firma*, where they met with a terrific gale of wind, which frustrated all their plans and nearly cost them their lives. This hurricane struck the balloon with great violence, sweeping it downwards towards the water and dashing it along at an awful velocity. All the ballast and everything that could be cast away were thrown out to enable the balloon to rise, but all in vain. Messrs. Hyde and Gager ascended to the basket, but Mr. La Mountain kept his position in the boat, even while it sometimes dashed through the tops of the waves of the lake. Mr. Wise was hopeful that they would be saved, but to every appearance they were all doomed to lose their lives. At last the balloon rose about one hundred feet, but with more apparent danger still, for onward it swept towards the land, and went crushing through the tops of the trees, smashing them like pipe stems, and continued thus for about one mile, until its progress was arrested by a tall oak; and we are happy to state, although the boat, basket, and balloon were much injured, a kind Providence preserved the lives of the daring aerial voyagers, who escaped with only a few bruises.

"Thus ended the longest balloon journey on record; it was commenced at St. Louis on the evening of the 1st inst. at 7·20 P. M., and completed near Adams, in Jefferson county, N. Y., at 2·20 P. M., on the subsequent day. The distance travelled was 1,150 miles; the time occupied 19 hours; a speed compared with which, that of the locomotive is as that of a donkey to a deer. The highest point attained was a little over two miles; and it appeared to be a very pleasant voyage until the parties met with the gale, in which the balloon became perfectly unmanageable.

"Although this aerial voyage is the longest on record, it does not appear to have added to our stock of knowledge in regard to making ballooning safe and practicable."

THE *Liberia Advocate*, of Monrovia, Africa, announces that its publication terms are: "One bushel of unhulled coffee per annum in advance." Money appears to be an unknown article among the printers of the West Coast.

The Atlantic Telegraph Cables.

We chronicled last week the successful laying of the fifth Atlantic telegraph cable by the Great Eastern, and we now give a few additional interesting particulars:

The squadron consisted of the Great Eastern, Captain Halpin, in charge of the expedition; the Hibernia, 3,000 tuns, Captain Cato; Edinburgh, 2,300 tuns, Captain Manning, and Robert Lowe, 700 tuns, Captain Tidmarsh. The last three vessels are all screw steamships, the Great Eastern having both paddles and screw. The electrical staff was in charge of Mr. Laws.

Each of the four ships is fitted up with laying machinery and picking-up apparatus, similar in general character, but with slight variations in details in order to meet special points as regards the build and equipments of the vessels. The arrangements on board the Great Eastern, of course, serve as a type for the other ships.

The cable lies coiled in lengths or divisions in tanks filled with water; and as each length is being laid, it passes along a trough, guided at intervals by horizontal and vertical friction pulleys, to the paying out apparatus in the stern of the vessel.

This consists of a series of six wheels, having V grooves over which the cable passes, each wheel being connected with weighted levers attached to disk wheels working in the V grooves, and acting as brakes. Each of the V wheels is also connected through its shaft with a friction brake. The whole of the lever brakes can be operated simultaneously from one main shaft if necessary. The cable, after passing over this brake apparatus, takes four turns round a drum 6 feet in diameter, connected with a powerful strap brake, and is passed thence to the dynamometer, by which the strain on the cable can be ascertained at any moment of its passage through the apparatus.

From the dynamometer the cable passes over a grooved pulley 5 feet in diameter, which projects over the stern of the ship.

The picking-up apparatus is placed in the bows of the vessel, and consists of grooved pulleys projecting over the stern, and a coiling apparatus having two drums, each six feet in diameter. The coiling apparatus is worked by a small engine which takes steam from one of the main boilers. A dynamometer placed between the bow pulleys and the coiling engine completes the picking-up apparatus, which, no less than the paying out gear, is as perfect as engineering skill, guided by past experience, can render it.

The grappling ropes are of various sizes and strengths, and are adapted for heavy or light work. They are made of wire, the heaviest rope being composed of six strands, each containing six wires, and he lightest having three strands of three wires, there being two intermediate sizes.

The Great Eastern also carries eleven iron buoys of five different sizes, ranging from 11 feet diameter by 15 feet high, to 4 feet 6 inches in diameter by 5 feet high.

It may here be interesting to note the lengths of each of the Atlantic cables. That of 1865, which has recently broken, is 1,896½ miles long, and the cable of 1866 is 1,868½ miles. The French cable of 1869, from Brest to St. Pierre, is 2,557 miles in length; while the line just laid is about the same length as that of 1865. Since the latter cable broke, the French cable parted 208 miles from Brest in about 500 fathoms of water. The accident was repaired by the Hibernia, a length of 100 miles having been cut out and replaced by a similar length of new cable.

A most interesting and important work will be the grappling for the cable of 1865, which broke a few months since. It will prove interesting, inasmuch as it will determine whether the physical condition of a cable which has been submerged for eight years is such as to allow of its being raised, or, in other words, whether the outer covering will have become so deteriorated that it will no longer possess the strength necessary to resist the great strain which will be brought upon it in raising it. Of its being found and grappled there is but little doubt, the same thing having been accomplished before under less favorable circumstances and with more limited experience than in the present instance. The matter derives its importance from the fact that, if the results are successful, it will prove a great commercial gain to the enterprising company to whom it belongs. The cable has parted in about nineteen hundred fathoms of water, and, so far as has been ascertained, the bottom is of a favorable nature for grappling operations. The Great Eastern and her consorts will continue their efforts to recover the cable up to the middle of September, or even longer if necessary, for she is equipped for a four months' voyage. It is, however, to be hoped that her labors will have terminated successfully before that time, and that yet new honors will have been added to the science of submarine telegraphy.

ACCORDING to M. Archheim, by the action of the vapor of bromide of phenylbutylene on lime heated almost to redness, large quantities of naphthaline have been obtained. The reaction is stated as follows: $C^{10}H^{12}Br^2 = 2\,H\,Br + H^2 + C^{10}H^8$.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From June 13 to June 19, 1873, inclusive.

CARBURETER.—H. L. McAvoy, Baltimore, Md.
HORSE SHOE.—H. & P. Moran, New York city.
PARING APPLES, ETC.—R. Spurge, New Rochelle, N. Y.
RAILWAY CAR.—T. R. Timby, Tarrytown, N. Y.
SHIP'S BERTH, ETC.—B. Weisker, New York city.
SPIKES, BOLTS, ETC.—G. N. Sanders *et al.*, New York city.
STEAM TRAP.—L. P. Hawes, New York city.
TELEGRAPH.—G. Little, Rutherford Park, N. J.
TELEGRAPH CONDUCTOR.—W. Radde, New York city.
TELEGRAPH, ETC.—F. H. Greer (of New York city), London, England.

Recent American and Foreign Patents.

Improved Beer Cooler.

Jacob Gimlich, Pittsfield, Mass.—This invention has for its object to furnish an improved apparatus for cooling beer, mineral water, etc., which shall be so constructed as to thoroughly cool the beer without injuring its flavor. In the box beneath the ice chamber is placed a cask to receive the beer from a cask placed in the cellar or other convenient place. The beer is introduced into the cask through a pipe inserted in one of its ends Three or more wooden tubes pass through the cask from end to end, and are placed at different hights in said cask. The ends of the tubes that project from the heads of the cask are connected alternately by flexible tubes so as to form a continuous pipe. The lower end of a pipe is connected with the end of the lowest tube, and its upper end extends up nearly to the ice chamber. It is made funnel shaped to receive the ice water from the discharge pipe of the said ice chamber. By this arrangement the ice water is introduced into the lowest tube and escapes from the highest, the discharging end of said highest tube being provided with a short elbow pipe so that the said tube may be always full. An air chamber is placed in the box above the cask and below the ice chamber, and is connected with the said cask by a short pipe. The air chamber is designed to receive any excess of gas that may be in the cask and which might prevent the said cask from being readily filled.

Improved Spring Bed Bottom.

Charles Gammel, Utica, N. Y.—This invention consists in improving the construction of bed bottoms. The ends of the wires that form coiled springs, at each end of said springs, are bent to form squares of a little larger diameter than the springs. The springs are arranged in rows and alternately. In the vacant spaces between the squares of the springs are placed squares of wire of such a size that their sides may be parallel with and close to the sides of the other squares. The adjacent sides of all the squares are hinged to each other by pieces of sheet metal bent so as to clasp said parallel sides in such a way that the said wires will turn freely in the said clasps or hinges. The end parts of the bed bottom may be turned up over the middle part, thus enabling the bed bottom to be folded into a convenient form for convenience in handling, storage, and transportation without straining the springs. To the lower side of the parts or sections of the bed bottom are secured pieces of Brussels carpet, or other firm thick cloth, to rest upon the slats of the bedstead and thus prevent noise when the bed is being used.

Improved Varnish or Bronze Coating for Articles of Plaster.

Charles Rotter, East Birmingham, Pa.—The object of this invention is to furnish a durable bronze varnish in different colors for coating and protecting plaster of Paris, terra cotta, stucco, wood and iron ornaments, and busts, which may be placed outside, exposed to the weather, or inside, to be cleaned by the use of water, as occasion requires. The brilliant hue and the protecting qualities of this varnish make it specially useful for busts and plaster ornaments. The invention consists in the mixture of "mica silver" and "aurosit" with collodion, in connection with aniline and other colors to produce different tints.

Improved Heating Stove.

Thomas H. Salmon, Brooklyn, N. Y.—This invention relates to stoves which have a down draft through the fuel, and consists in the arrangement of a plate to form that side of the hanging grate, which is opposite the smoke pipe. Through a hollow standard a pipe passes upwardly into the combustion chamber. In the latter is hung the basket grate that is provided with a removable cover through whose holes the air is drawn to produce the down draft. One side of the basket grate is a broad plate, which comes directly between the smoke pipe and the other part of the grate. By this construction, when there is sufficient heat to create a vacuum in the chimney, a current of air rushes through holes through the fuel in the grate under the plate and into the chimney. In order to moderate the strong draft which is thus produced, slides in the ash pan are moved so as to admit air.

Improved Till Alarm.

John F. Baldwin, Nashua, N. H., assignor to himself and Miles Alarm Till Manufacturing Company, Providence, R. I.—This invention consists of one or more disks setting up in a plane parallel with the drawer front, on pivots, and having notches in the curved upper edges, which have to be brought in the line of a hook on a stationary support above the drawer by the pull rods, to allow the plates to pass the hook to open the drawer without sounding the alarm. The plates have several notches in the edge, and all but one are fitted with removable pieces, which can be shifted from one notch to the other to change the combination. When two plates are used they will swing in opposite directions, and their open notches must coincide with each other as well as the hook, to allow the drawer to be opened. When an attempt is made to open the drawer by one not knowing the adjustment, the hook will push one of the plates against the trip lock of the bell hammer and free it so as to sound the alarm.

Improved Governor.

Elson Towns, Cisne, Ill.—This invention relates to apparatus for governing the speed of machinery, more especially designed for the steam engine. A curved bar is attached to the frame with its curved end hanging over so as to support the top end of the ball spindle. A loose disk or washer moves freely up and down on the spindle, and by means of two pins it rests on the arms of the balls so that when the balls rise or fall the washer follows their motion. An adjustable disk is supported by a forked spring to which it is jointed. This spring is adjusted so that the friction wheel is raised or lowered thereby. The friction between these two wheels retards the motion of the balls. The driving shaft is confined to the stand of the frame upon which shaft is a bevel wheel. A yoke carries another wheel which meshes into the latter. This yoke is connected to a vertical shaft by a pitman. The yoke is so constructed that it turns, with the wheel, on the driving shaft, and when the speed is increased the yoke will raise the shaft and weight, but the increased speed is imparted to the spindle and will raise the balls. If more than the required speed is attained the friction wheels will be brought in contact, which will produce a counteracting effect. The difference between the extremes is the speed required, and a is varied by the adjustment of the upper friction wheel. The weight on th lever is raised by an increasing velocity, but the tendency to raise is counteracted by the friction caused by the rising of the balls. The opening the valve, therefore, does not depend upon the action of the balls, as in ordinary governors, but by the positive action of the gearing. The balls simply check or limit the action of the yoke by means of the friction produced.

Improved Flour Mill.

Jeremiah Dean, New Baltimore, Md.—This invention is an improvemen in the class of mills the runner of which is provided with scrapers or plate so attached to it as to remove the meal from an annular trough, into which it falls after escaping from between the stones. The improvement consists in a series of straight ribs applied to the under side of the runner so as to be tangential to the shaft, around which their inner ends center, while their outer ones extend beyond its periphery, and are beveled, whereby said ribs will operate to force the meal outward from the center of the stone, and also carry it around to the discharge orifice of the casing.

Improved Dumping Apparatus.

George W. Reed, Middlesex, Pa.—The object of this invention is to construct, for use in collieries, mines, and other purposes, a dumping apparatus by which coal or ore may be conveyed and discharged over the chute by one attendant in a rapid and effective manner. This invention consists, mainly in a platform pivoted into the hoisting frame, to which the loaded car is securely locked and dumped, the doors opening and closing by suitable mechanical means. To operate the apparatus the car is secured to the platform by the stops and pin, and tipped over by the slide lever opening its door and discharging the load. The platform is then brought back to the cage, secured to it, and replaced by another, or lowered to be refilled.

Improved Method of Adjusting Circular Saws.

Sanford W. Clemmens, Cleveland, Ohio.—It is proposed to have a loose collar or disk between the saw and the fast collar, with adjusting screws screwing through the fast collar against or into the loose collar to adjust the saw true in case the fast collar is not exactly true, or in case the saw itself is not ground true.

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Improved Wall Paper.

Archie W. Paull, Wheeling, West Va.—This invention consists in simply taking a carefully selected and artistic design, prepared on paper, wood or other material, and photographing it directly upon the wall paper. In this manner are secured as many facsimiles as may be desired of a design whose delicacy of tint, exact imitation of nature and elaborate ornamentation are absolutely impossible in the block printing process.

Improved Piano Tuning Key.

Alexander H. Affleck, Marshallville, Ga.—This invention relates to tuning keys for pianos, and consists in one so constructed that, no matter in what position the angular top of pin may be, the key can be quickly rotated so as to give a good purchase and a convenient hold.

Improved Automatic Gate.

Geo. C. Crum, Barr's Store, Ill.—This invention relates to that class of gates which are opened and closed automatically as the vehicles approach, and subsequently closed behind them after the passage of the vehicles therethrough. The invention consists in combining with a gate latch a vibratory lever with arms connected at the lower end with a bar inclined on its subjacent face.

Improved Drop Light Attachment for Chandeliers.

Napoleon W. Williams, Philadelphia, Pa.—This invention consists in attaching the ball which holds the rubber pipe to the bottom of the sliding pipe and making it movable therewith, and also in a peculiar construction of the surfaces of the friction clamp.

Improved Automatic Hatch Closer.

Edward M. Hackett, New York city.—This invention relates to means whereby the door or doors, that cover the openings in floors through which pass elevators, may be automatically closed and opened. It consists in causing a pin on the elevator to move through two spiral grooves and thus vibrate a vertically journaled shaft, which has an arm or arms that actuate the door or doors.

Improved Ribbon Case.

Jos. K. Landis, Bellevue, O.—The object of this invention is to furnish an improved receptacle or holder for ribbons and other like fabrics, also for threads, yarns, etc., the same being adapted for use in fancy dry goods shops, also, when in smaller dimensions, in families, by milliners, seamstresses, etc. The invention consists of a polygonal revolving case, in each of whose compartments is a series of spools or shafts on which the ribbons are wound, the same passing through slits formed in the outer face of or side of each compartment.

Improved Gas Retort.

Joseph D. Patton, Trevorton, Pa.—This invention consists of a retort protected from direct contact of heat by the brickwork in which it is set, or partly by the same and partly by another retort, in combination with one or more retorts wholly exposed to the heat of the furnace, for gradually heating the substance of which the gas is to be made; the object being to provide an arrangement whereby resin or volatile oil can be successfully treated, in which they are subjected from the beginning to the intense heat of retorts directly exposed to the heat and sufficiently hot to convert them into fixed gas, which they cannot be in the ordinary retorts.

Improved Paper File.

Charles Mason, New York city.—The object of this invention is to furnish to merchants and business men a cheap, durable, and convenient paper filer, by which letters, bills, checks, or other papers may be quickly and neatly filed and compactly held together. The invention consists of a device bent of suitable wire or other metal in such a manner that the top part holds, in connection with the spring action of the bottom and side parts, the papers placed on file between them.

Improved Coupling for Elastic Hose.

Thos. J. Trapp, Williamsport, Pa.—This invention consists in a tube provided with a tapered or conical end, terminating in a right angled shoulder. The elastic hose is forced over said conical end, and past the shoulder, with which latter it engages so firmly as to resist all attempts at removal by any tension to which it may be subjected short of that which will destroy, cut through, or tear it.

Improved Furniture Caster.

Cevedra B. Sheldon, New York city.—This invention consists in the peculiar shape of the two similar and half sections, each having its half rim, its inner face, its half hub and its cup, corresponding to like parts in the other.

Improved Combined Walking Planter and Cultivator.

George De Vany, Jr., Darbyville, O.—This invention relates to a combined single and double walking seed planter and cultivator, the component parts of which are so constructed as to permit the planter to be changed either into a three or double shovel cultivator by a simple transposition of said parts.

Improved Chain Harrow.

George Watt, Richmond, Va.—This invention consists in a harrow, pulverizer or cultivator composed of a series of chains connected by loop links and held in position by cross bars, together with a pair of bars attached to a clevis at one end and braced intermediately by a spacer.

Improved Clothes Line Hook and Automatic Fastening.

John G. Ames and Preston A. Ames, Baltimore, Md.—This invention consists of an automatic hook and fastening for clothes lines, consisting of a fence grapple with slot and bearings, and a line hook having journals and rear projection. These may be attached to the top of a paling or fence without nail or rivet, and, when not in use, safely stowed away.

Construction of Iron or Brass Pulleys or Caster Wheels.

Cevedra B. Sheldon, New York city.—This invention consists in making the pulley or caster wheel in two sections, on a plane passing through rim and at right angles to the plane of axis, and in connecting the two sections together by a hollow rivet which also serves as an axle box to take up wear.

Improved Geared Hand Carriage.

Lewis T. McGilvray, Staunton, Va.—This invention consists in combining, with a vehicle having ordinary sustaining wheels and a guide wheel in front, a series of crank shafts and intermediate gear wheels, by which power is easily and conveniently transferred from the hand to the axle.

Improved Paint Brush.

Syranus Standish, Eureka, Nevada.—This invention relates to paint and other brushes, and consists in a novel mode of constructing and combining the handle, bristle compressor and shell, so that the bristles may be adjusted when worn, utilized almost entirely, and then replaced with new bristles, all with but little trouble and by almost any one.

Improved Stationary Spittoon.

Wm. H. Tyrrell, Philadelphia, Pa.—This invention relates to spittoons for cars, steamers, ships or vehicles; and consists in an improved construction which allows the same to be conveniently emptied of its contents at times intermediate between the termini of route and with ease and convenience to the operator.

Improved Mangling or Wringing Machine.

Thomas Hall and James Newton, Lawrence, Mass.—This invention consists of an arrangement of long levers and springs to obtain the pressure on the pressure roller by light and sensitive springs, which are better adapted for obtaining a wide range of movement than the strong heavy springs which are necessary when short levers are used.

Improved Spring Bed.

Stephen Stout, Tremont, Ill.—The object of this invention is to construct a cheap and durable spring bed of simple construction. It consists of grooved lateral supports for double acting spiral springs, which are connected by slats or cane pieces, and held in position by straps passing through the springs.

Improved Sled Brake.

Joseph Slater, Sandy Lake, Pa.—This invention is an improvement in the class of sled brakers, wherein a pivoted bar is caused to take into the snow or ice by means of a hand lever. The improvement relates to arranging a sliding rod, provided with a hook or claw on its free end, in connection with an oscillating lever shaft and a keeper and supporting guide, so that said rod may be easily and powerfully applied as a brake, and raised and supported in a horizontal position beneath the sled beams when not in use.

Improved Ear Protector.

Moritz Isidor, New York city.—The object of this invention is to provide suitable and convenient means for protecting the ears from frost and cold; and it consists in shields or coverings for the ears, connected together by an elastic cord, and with the central fronts or outsides formed partly of cloth and partly of gauze, so that the shield will not interfere with the transmission of sound.

Improved Hoisting and Conveying Apparatus.

George Stancliff, New York city.—The object of this invention is to hoist, convey, and lower heavy goods in an easy and expeditious manner, for the purpose of economizing time and labor. The invention consists of a truck, hoisting and carrying the weight and moving it back and forth on an inclined track by means of a windlass, wire rope, and pulley arrangement. It is intended as an improvement on a similar invention patented by Joseph Green, August 1, 1871, and which may be found illustrated in the SCIENTIFIC AMERICAN, on page 383, December 16, 1871.

Improved Ladies' Work Stand.

Gilbert S. Manning, Danville, Ill.—This invention consists of a stand composed of legs and boxes or trays, and an inclosed revolving table top with a cover in two parts opening and closing on pivots at one end, which secure a base plate upon the covers, whereon a revolving inclosed spool stand is provided. The arrangement is calculated to provide a neat, desirable, simple, and inexpensive table.

Improved Car Pusher.

Alva S. Bailey, Paxton, Ill., assignor of one half his right to Edward Little, of same place.—The object of this invention is to furnish to railroad employés and others a car jack, by the use of which cars may be moved on the track without being required to wait for a locomotive, horse, or hands. The invention consists of a main beam, with clutch end placed on the track, a slide lever with rack and hook at the other end being applied to the car and acted upon by a cog wheel at the end of a hand lever, so that by successive applications the car is moved on the track.

Machines for Swaging and Finishing Horseshoe Nails.

Robert Ross, Vergennes, Vt., assignor to National Horse Nail Company, of same place.—The first invention consists of a die on the side of a vertical wall, and a horizontal reciprocating die working toward and from it below a screw feeder, and a bar parallel with it, by which the nails are fed along, points downward, to these dies, to be beveled to the required shape flatwise at the points, the movable die being so timed as to come against the points as they pass in front of it. The feed screw and bar are adjustable vertically to regulate the length of the bevel for the points. The invention also consists of a weighted lever combined with said feed devices and beveling dies to retain the nails between the dies while being acted upon. There are also a vertical stationary die and a movable punch, and a pair of holding dies, in combination with the said feeding devices, for trimming the edges or narrow sides of the nails for about half their length from the point, more or less, the nails being presented to the said trimming dies by dropping, point foremost, from the feed devices in front of the stationary trimming die and being caught at the head by the holding dies, so that the point to be trimmed is suspended in front of the stationary trimming die and held till the movable trimming die comes up and forces it through the other one and out of the holding dies. One of the said holding dies has a slight movement to open and let the nails drop in freely, and then close on them to hold them snugly till the movable trimming die acts. The invention also consists of an arrangement of the stationary beveling and trimming dies on a supporting block, which is pivoted to the frame at one end, and confined by a locking pin at the other end in such manner that by removing the locking pin the block can be readily swung over on its pivot to afford ready access to said dies for repairing them; and an arrangement of the crank shaft is provided which works the movable die stock by a crank or wrist pin, so that it can slide away from the stock readily, to allow of withdrawing the stock to grind the dies without taking them off, and a combination of a latch and collar with the shaft for holding it in connection with the stock. The same inventor has also patented a machine for finishing horseshoe nails which operates as follows: The nail is placed between two threads of a screw. The screw being rotated carries it forward until it reaches a die where the hammer strikes and points it. It then passes to and off the screw end, against which it is held by suitable devices until the pushers carry it through other dies, the head of the nail causing the holder to rise. This effectually trims the nail. If a nail is larger than those previously pointed and trimmed, the screw is drawn back, and *vice versa*, if smaller; while increased space between the nails, as they approach the die to give room for the handle, is obtained by the increasing width of thread.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents*. This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office. Such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Rejected Cases.

Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate. Address MUNN & Co., stating particulars.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, for full particulars.

Design Patents.

Foreign designers and manufacturers, who send goods to this country may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row New York.

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On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee $20) or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, N. Y., who will give prompt attention to the business and furnish full instruction.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

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MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an *honest opinion*. For such consultations, opinions and advice, *no charge is made*. Write plainly do not use pencil, nor pale ink; be brief.

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Notes & Queries

C. C. R. asks: How can I make the best varnish for a violin?

E. H. R. asks: What is Box's process for treating peat for fuel?

T. A. asks for the process of stamping and retinning tin ware.

C. H. W. Jr. asks for the best method of softening the scale on cast iron.

D. B. B. asks for a plan for an oven for annealing small steel forgings. What is the best material for fuel?

J. H. says: Can any one give a rule for determining the relative position of the frets on the finger board of the guitar?

D. B. B. asks how he may heal a natural opening in the side of a young cow's teat. There is no projection, but simply an opening from which the milk issues.

J. A. F. asks: Is it considered dangerous to use rain water for drinking and culinary purposes if it is conveyed through lead pipes? If it is, what is the best kind of metal pipe to use?

L. A. C. asks how to make a composition of metals which will be nearly or quite as hard and durable, and will make as smooth and sound a coating, as brass, which can be melted in a common iron ladle.

J. A. F. says: Our court room is defective as regards accoustics. The room is 54x65x29 (pitch of story) with gallery at one end, extending (on the sides) half the length of the room, Can anything be done to improve it?

R. M. F. asks: 1. Which is the chief cause of the surf, wind, or tide? 2. In a dead calm, would the rise, distributed through a space of several hours, cause any surf on the coast? 3. During calm weather, how does the tide affect the surf where the rise and fall of the tide is 50 feet or upwards, or on any coast where the rise and fall is great?

S. D. S. asks: In a musical wind instrument, to be blown as a trumpet, what length of the instrument makes a tone, and what length makes a semitone? What is the length in inches measured on the instrument between C and C? If the instrument be one half inch diameter in the bore, will the distance for a tone and a semitone be the same as if the bore were three fourths of an inch in diameter? Would these distances be the same on a crooked instrument as on a straight one?

Answers to Correspondents

E. C. B. asks: 1. How does the fly wheel of the Scott and Morton revolving steam engine, illustrated in your edition of April 5, receive its motion? I don't understand how the power is applied to it from the cylinder. 2. How is it that salt is put on ice to preserve ice cream, but if it is put on ice on a sidewalk, etc., it melts it? Answers: 1. The fly wheel and cylinder are not concentric, the centers differing by a half stroke. Let A represent the position of the center of the cylinder, B the center of the fly wheel, and C the wrist pin when at the end of a stroke, the piston rod being as far out as possible. At the end of a half revolution the wrist pin will be at D, the piston being at the other end of the stroke. In the figure BC=BD, and AB= one half stroke. 2. Salt always melts ice, thereby absorbing a certain amount of heat from surrounding bodies; and since it takes heat from the cream, it cools it. On the side walk it also melts the ice, thus taking a certain amount of heat from the air, the stones, and the feet that travel upon it; hence car horses' feet are often frozen when the tracks are salted.

A. B. asks: What is the best method of amalgamating a large zinc cylinder for a Bunsen's electrical battery? To immerse the cylinder would require a large amount of mercury, and I cannot succeed by rubbing it on. If the zinc, after being washed in sulphuric acid, is immersed in mercury, and the greater part of the surface is not brightened in the least, and is apparently unaffected by the mercury, what is the cause and how can it be remedied? Answer: Into a flat porcelain dish containing 2 or 3 ozs. of mercury, pour half a pint of strong muriatic (hydrochloric) acid; roll your zincs in the dish, so that the acid and mercury will touch the zinc at the same time; in this way the mercury will unite (or amalgamate) with the zincs with very little rubbing. After this rinse them in clean cold water, and place them in the battery jars: pour clean water on the mercury left in the dish, until the acid is washed away, then pour the mercury into the jars, and the battery is ready for the solutions.

J. M. says: I have been trying to construct a galvanic battery, but have not succeeded. It is made on the plan of Daniell's constant battery, and consists of two copper cups each 6 inches high and 4¼ inches in diameter, with a perforated shelf near the top, ⅝ inch wide. Two porous cups 3 inches wide and ½ inch thick, and two solid zinc rods 1¼ inches in diameter, are used. The porous cups are placed in the copper cups, and the zinc rods are insulated and hung inside of the porous cups, which are made of round drain tile. In the porous cups I placed a solution of one part of oil of vitriol in seven parts of water, and in the copper cups, a solution of blue vitriol and a little oil of vitriol. After standing awhile, I took hold of the handles but could feel no shock, nor has it worked since. What is the matter with it? Answer: The electricity from a battery of two of Daniell's cells of the size you mention could hardly be felt with the hand; but if you place the terminal wires on your tongue, without touching each other, it can be tasted. The proper way for your purpose is to allow the electricity, direct from the battery, to pass through the primary coil of an electro-magnetic machine and then pass the induced current from the secondary coil of the instruments, through your body, and it will require no great sensitiveness to feel it. The instrument will cost ten or fifteen dollars, according to power.

C. M. W. says: 1. I have an electro-magnetic machine from which, at times, I can feel electric shocks through one conductor without any connection with the other whatever. How is this? 2. Can I fix the machine in any way so that I can get the shock through but one conductor without any connection with the other? If so, how? 3. Can I charge a chair or stool with electricity, or charge myself with it, so that a person touching any of the above can feel the shock without their touching the conductor? Answers: 1. This effect is very noticeable when using the induction coils or frictional machines. While experimenting at home with a small induction coil, we have frequently illuminated a six inch Geissler tube by holding it with the thumb on one of the platina terminals, and the other terminal within a half inch of one pole of the instrument, without any apparent connection with either pole; of course there was a connection, or passage, and it was through the air, as may be easily proved by connecting the outside coating of a well charged Leyden jar with the gas or water pipes (so as to expose a larger surface for the escape); on presenting the knuckles to the knob of the jar, the shock will be felt without it being necessary to touch the gas pipe or outer coating. 2. In reality, no, but the connection may be so disguised that it will not be apparent. 3. If you stand on a stool with crown glass legs, you may be charged so that you can, with your finger or an icicle, ignite alcohol contained in a tin cup and held by some person who need not be in direct apparent connection with the other pole. In this case, the same principle is involved as in the charging and discharging of the Leyden jar, namely, that it would be impossible to charge either without a connection being established with both poles. We think the best machines, for the class of experiment in which the connection or circuit is not apparent, are those that produce very intense electricity, such as the instrument of Professor Holtz (described on page 380 of our volume XVI) or the ordinary frictional plate machine.

H. W. U. asks if the common burning gas will pass through water in a gas pipe, with the ordinary pressure. Answer: A column of water, one inch cross section and about 2·3 feet high, weighs one pound. Gas, to rise through a column of this hight, must consequently have a pressure of one pound per square inch; and the pressure required per square inch will vary with the hight of the column of water through which it is to pass.

A. W. asks: 1. How much horse power will it require to raise water through a tube one inch diameter from thirty to forty feet perpendicular? 2. Does condensed air press as many pounds on the inch as steam does? Answers: 1. Multiply the number of pounds of water delivered per minute by the hight to which it is to be raised, and divide the product by 33,000. This will be the horse power required, to which must be added the friction of the water in the pipe. 2. Yes.

C. P. W. asks: About how many degrees of heat will water absorb under a pressure of one hundred pounds? In other words, does not water change into steam at 212°? Answer: According to the generally accepted theory of heat being a mode of motion, water does change into steam, under atmospheric pressure, at a temperature indicated by the thermometer of about 212° Fahr.; but before it changes its condition, it requires an addition of about 967° of heat, which are not indicated by the thermometer, but can be observed by condensing the steam. This amount of heat, which is ordinarily called latent heat, is supposed to be converted into the work exerted by the particles of water in changing into steam.

F. W. asks: Will the iron radiator used for steam heating radiate as much heat in proportion to internal temperature if filled with hot water instead of steam? Answer: If the circulation is equally good, in both cases, the amount of heat radiated in proportion to temperature will be the same.

G. W. F. asks: 1. Is water compressible? If so, to what extent for a given amount of force? 2. Is there any ratio between the compressibility (if such exists) of different liquids and their specific heats? Or to put the matter conversely: Supposing an equal quantity of heat be applied to substances of different specific heat, water and mercury, for example, is the force of expansion the same or different in each case? Answers: 1. Water is compressible to the extent of about fifty millionths of its volume by a pressure of 15 pounds per square inch. 2. There is no such ratio. Generally, the most expansible liquids are the most compressible.

W. S. says: We have in a mine a pump with the discharge and suction pipes both 4 inches in diameter. From the discharge pipe we connected a 6 inch pipe for a column which is nearly 1,000 feet up a slope. 1. S. J. claims that there is no more weight of column on the pump with a 6 inch pipe than there would be with a 4 inch pipe. D. R. J. claims, on the contrary, that there is, for the reason that the 6 inch column will hold more water than the 4 inch, and this makes the column heavier. Answer: There is certainly more weight of column when the 6 inch pipe is used, but the pressure on the pump piston is the same, in each case. The pressure on the base of a column of liquid is proportional to the hight of column and area of the base, and independent of the cross section of any part of the column, other than the base.

J. J. Y. says: In a factory in this place, pressure is obtained by means of a lever or handle attached to an eccentric. How is the power obtained by it calculated? Is it done in the same way as with a simple lever, the fulcrum of which is the axis of the eccentric? If not, how? Answer: This is simply a bent lever, and the calculations are made in the usual manner.

J. H. asks: Are bristle cuttings of any value as a fertilizer? If so, how could they be prepared? Answer: Mix with wood ashes and use as a fertilizer.

R. F. says: W. B. asks for a recipe for cement that will resist oil on the joints of a tin box; I suppose he means the joint round the cover. I have proved that thick shellac varnish, made with alcohol as a solvent, applied to the inside of a leather vessel, will hold whale oil three to five months: therefore I conclude that, if W. B. makes a thick paste by dissolving gum shellac in water by heat, and applies it thoroughly to the joint and, when dry, cements a strip of paper by the same paste around the joint, he will accomplish his purpose; or if he labels his boxes, let him cover the joint. Gum shellac dissolved in water as above is the best cement I ever found for labeling on bright tin; and by using it, he will accomplish a double purpose.

J. H. M. says, in answer to W. H.'s query about foul water in a well: Let him clean out his well, take out his pipe, fasten or solder on a piece of wire screen, about one sixteenth inch mesh, on the lower end of the pipe and bore a number of half inch holes through the pipe within a foot or two of the bottom end, covering the holes also with the wire screen. Insert the pipe in the well, having it terminate in the center of the bottom of the well, and then fill up the well with clean washed gravel. The same thing can be done by using a pump log instead of pipe, and serving in same manner. I was troubled in the same manner that W. H. was, and have tried the above plan and it gives me the best water in this vicinity. It might, perhaps, be an improvement to occasionally put in a layer of charcoal when filling up with gravel, the coarsest charcoal being in the bottom of the well. Will W. H. give us the result after pumping out the water enough to clean the gravel? If the stones of the well were taken out, before filling as above it would be still better.

M. V. B. asks: Are meerschaum or other pipes made from froth of the sea? Are they not made from clay found in some parts of Europe? Answer: Meerschaum is a German word, signifying sea foam, and is applied to the mineral silicate of magnesia—of which meerschaum pipes are made—on account of the light and white nature of the substance. The best qualities come from Asia Minor.

E. J. C. asks how to burnish gilding on china. Answer: We give the following from Wagner's "Chemical Technology:" The gold employed for decorating the porcelain is dissolved in *aqua regia*, and precipitated with either sulphate of iron, nitrate of protoxide of mercury or by means of oxalic acid. In its application the gold must be intimately mixed with a flux, generally nitrate of bismuth. The article to be gilt must be thoroughly freed from grease, else the gold will not adhere. The gold powder, finely ground up with honey or sugar, or some such soluble substance, is applied with a pencil brush. The burning in is effected in a muffle. The gold is not melted during the burning, but becomes firmly set upon the article by means of the flux. After burning the gold does not at once appear bright, but requires burnishing with an agate tool. Bright gilding is effected by burning in a solution of sulphuret of gold or fulminating gold in balsam of sulphur which requires no burnishing.

J. T. D. asks what is the best work on mineralogy. "I would like to have some good work to assist me, as I find rocks that I cannot understand. 2. What would it cost to have ores of silver and lead assayed?" Answers: 1. Use Dana's "Mineralogy." 2. Assays of lead, gold, or silver cost $10 each.

J. L. S. asks: Why is it that a certain quantity of inflammable gas, burning in an ordinary gas stove gives out so very much more heat than when consumed in the common form of a light? I can easily understand how the heat is greatly increased by means of the free access of oxygen in the air, but can conceive no cause for the astonishing difference that actually exists. The same amount of gas burned in open air, even when it is bountifully supplied with oxygen, produces a sensible heat, insignificant when compared with that emitted from the gas stove. Is the heat generated in the two cases actually so different in intensity, or is it approximately the same, but only more generally diffused in the latter instance? If the last be true, why? Answer: Gas burned in a gas stove or Bunsen burner is mixed with air so as to be completely consumed; hence we have a blue flame and no light. In an ordinary batswing burner the air has access only to the outside of the flame, and the heated particles of unconsumed carbon give luminosity to the flame. In a gas stove, too, the arrangement is such as to heat as large a current of air as possible, and to diffuse the heat in all directions. You will find this fully explained in any work on chemistry or cyclopædia, under the title of combustion. The oxyhydrogen blowpipe produces a more intense heat than any stove or furnace, because the combustion is perfect, yet it does not heat a room where it is used so much as your gas stove, because it is not so arranged as to readily diffuse this heat through the surrounding atmosphere.

W. E. M. asks: Is there any process by which silicate of soda or potash, after it has been dissolved in boiling water, can be made to possess the same qualities as before dissolving? The qualities I desire are as follows: It must be nearly or quite transparent, nearly or quite insoluble in cold water, and must stand a heat of 600° Fahr. Thus far I have failed to get a satisfactory result after dissolving. I have tried chloride of calcium, which leaves an opaque silicate of lime, and does not answer. I have tried drying it in a heat of 130°, which is the greatest degree it will stand; and, after allowing it to dry in the air for three or four days and in this heat for eight hours, it would not then stand 150° without blistering. I must have it in the liquid so as to apply it in successive coats until I get a thickness of ⅛ of an inch. Would dissolving it in any other liquid which is not very costly give a better result? Answer: Try using it in a state of fusion, either by fusing the commercial dry silicate of soda, or by fusing a mixture of pulverized quartz 45 parts, calcined soda 23 parts, carbon 3 parts, and pouring the melted glass over the surface, which should be warmed also.

J. J. G. asks why vermilion turns dark, and if there is any remedy that will make the color permanent. Answer: Vermilion of commerce often contains red lead and chrome red, which blacken in an atmosphere containing sulphur. Pure vermilion can be sublimed, leaving the impurities behind. Blackening may also be due to a molecular change, difficult to account for and more difficult to prevent, since there is both a red and a black sulphide of mercury, the latter being the most stable.

J. A. H. asks: 1. Which of the elements is it that will not combine with oxygen, as stated in Roscoe's "Chemical Primer"? 2. How is it that some works on chemistry give 64 elements and others 63? Which one are they uncertain about? Is it pelopium? Answers: 1. Oxygen will not combine with fluorine. 2. Nearly all text books, including Roscoe, Barker, Cooke, Rolfe and Gillett, Gorup-Bessanez, Steele, Attfield, mention but 63 metals. Pelopium was the name given by H. Rose to a metal supposed to exist in American columbite, along with columbium or niobium. He afterwards concluded that what he had supposed to be pelopic acid was only another compound of niobium. It has since been discovered that both these errors were caused by the presence of tantalum. Jargonium and norium were also once supposed to be new elements.

C. M. P. says: I am constructing a telescope. 1. Would an instrument with a 4 inch objective be large enough to aid in the study? 2. I have devised a machine which will grind a perfect lens of any size or shape; but I do not know how to give glass the fine polish necessary. Please inform me of the process and the materials used. 3. Please inform me what would be the cost of good lenses, of the size mentioned, at the manufacturers? What would be the cost of a complete instrument? What standard work on astronomy would you recommend? Answers: 1. We should recommend a telescope of four inches aperture. The price of such a lens is $100; with equatorial mounting, complete, about $250. 2. Your device was anticipated by an experiment of Professor Boyle of this city. A local polisher of rhomboidal shape, moving in cycloid curves, was found to correct a four inches lens in twenty minutes. Directions for grinding and polishing specula are given by Professor Henry Draper "On the Construction of a Silvered Glass Telescope" (*Smithsonian Institute*, price $1.) 3. Useful standard works are, for observers: Proctor's "Star Atlas," Guillemin's "The Heavens," and Schellen "On Spectrum Analysis;" and, for students, works by Loomis and Chauvenet.

W. asks: Will zinc and lead fuse together so as to form a perfect alloy? If so, are there any particular directions to be followed? Answer: Zinc and lead will probably form an alloy. Zinc must be fused in a covered crucible to prevent its taking fire. Their melting points do not differ greatly.

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W. W. S. asks: Did the supposed planet cross the disk of the sun or not, on March 24? I can in no way find out. Answer: It is stated that Vulcan was seen to cross the sun's disk on March 14, 1873 by Mr. Cowie at Shanghai, China. Its sidereal period is 34 days, 22 hours, 31 minutes. The existence of other intra-mercurial planets is inferred. A sharp lookout should be kept for them. Mr. John H. Tice of St. Louis states that, in 1859, he saw the planet pass the sun's disk.

W. S. D. asks how to cover glass with a thin coat of tin in a liquid form, in the manner that silver is put on or in any other way, so as to be bright like silver. Answer: We know of no method of coating glass with tin from a solution. An amalgam of tin and mercury is employed on mirrors, in which case the tin foil is used and the mercury poured over it.

O. M. asks: 1. Have the flame protuberances on the sun ever been seen by simply viewing them through properly colored glass and a telescope, without the intervention of the prism? 2. Are all the flames of the same color, so that all may be seen if any are? 3. Where may properly colored glass be obtained for this purpose? I think some noted English spectroscopist saw the flames in the manner indicated above, but I am not certain of this. Answers: 1. Dr. Huggins' experiments with colored media were unsatisfactory. 2. The solar prominences have been seen in a three inch a hromatic, using a direct vision spectroscope of five prisms, and magnifying the spectrum with a small telescope. Usually the light is sent through five and a half prisms of dense flint glass. In the spectroscope, the light of the protuberances is concentrated in these images at the hydrogen lines (C, F, and G, of the solar spectrum), while the general light of the sun becomes faint by dispersion. We usually look at the red image at C and photograph either the bluish green one at F or the violet one at G.

R. C. P. says: I built 2 steam boilers 26 feet by 36 inches, with a 14inch flue in each; they were tight with 60 lbs. of steam; but fearing that they leaked (where we could not see the place) when they were hot, we tested them with 63 lbs. cold pressure; and with this test they leaked at places where they showed no signs of leaking with steam on. Did the cold pressure strain them more than the hot? If so, what is the difference? Answer: It is evident that a boiler when cold is in a different condition than when heated. Boilers may be tight in one case, which are slack in the other. Joints may be quite open, when the boiler is cold, which will be closed by expansion, when steam is raised. An article published in the SCIENTIFIC AMERICAN some years ago describes an excellent method of testing boilers; and as it is one that we can thoroughly recommend, we reproduce it here, as a matter of interest and importance to those who have charge of boilers: "If a boiler be filled full of water up to the very safety valves, and all apertures closed, when a fire is built in the furnace the water will be expanded and raise the valve, if the boiler is strong enough to withstand the strain; but if it is not, the weakest part will be shown, and sometimes sheets are torn out by this method. Steam is not generated from the water during this test, and if a rupture does take place in the boiler, no one will be injured by it."

J. R. says: Can a hot air engine be run by suction? If so, cannot the suction be formed by condensing rarified air? Will rarified air act with the same pressure upon the piston as condensed air, there being a vacuum produced in the receiver? If so, cannot power be gained, the action of heated air being the same in power as that of condensed air? The dense air is pumped out of the receiver through a smaller aperture than that of the receiver or rarified air pipe through which it is fed. Answer: If we understand our correspondent rightly, the same bulk of air must be pumped out that is admitted to the cylinder. The application of heat to air causes it to expand, or, if expansion is prevented, increases its pressure. Our correspondent's idea seems to be both to increase the pressure and volume of the air.

C. H. H. says: A boiler in this section was destroyed, either by a collapsed flue or by its back head giving way. It was of 40 inches diameter, 20 feet length, ¼ inch shell, with ¼ inch heads; the flues were 14 inches diameter of heavy three sixteenths inch iron. The boiler carried 98 lbs. of steam. The boiler was thrown a distance of 10 or 12 rods and pieces of saw logs were driven into the boilers. One log was driven into one of the flues for a distance of 10 or 12 feet, tearing it open about 4 feet in length. The boiler struck a white oak stump, about 30 inches in diameter, splitting it open at a right angle with the direction of the boiler. It finally struck a large oak tree, which apparently stopped the force and changed ends of the boiler. The front head was torn out, one or two sheets being badly torn and the back head nearly all out. The force was exerted from the back head. The boiler was old. No one was injured. What caused the trouble? Answer: In the SCIENTIFIC AMERICAN for April 26, 1873, will be found a formula for ascertaining the pressure necessary to collapse boiler flues, made of good iron and truly cylindrical. Applying the data given in our correspondents letter, we find the pressure per square inch necessary to collapse these flues to be about 103 pounds per square inch; so that we can hardly err as to the probable cause of the present explosion. We have alluded before to the excessive working strains to which boiler flues are frequently subjected, and to the great danger of the same; and we hope that our readers will aid us, by communications, to rouse the owners of steam boilers to a sense of their criminal carelessness.

A. asks if the sun differs in distance from the earth in any parts of the year; and if so, what is the difference, and at what time does it change? Answer: The mean distance of the earth from the sun is now estimated at 91,678,000 miles. On June 30, the sun is 2,500,000 miles further away than at the end of the year, when it is nearest the earth.

E. G. says: Can you tell me why my boiler always leaks when the water is unusually high in it? It is 54 inches in diameter and 14 feet long, with 65 two and three quarter inch flues. Sometimes it will be perfectly tight for weeks; but if by any neglect the water is allowed to get 2 or 3 inches above the highest gage cock, it will leak at every joint, and sometimes troubles me for days before the leaks stop up again. Answer: It is impossible to answer a question of this kind without looking at the boiler. Still, we will advance a theory which might possibly account for the leak. The boiler may be set in such a manner that it can just sustain its own weight and that of the water which it contains when the proper water level is maintained. Raising the water level three inches will increase the weight between 900 and 1,000 lbs., and this may bring a strain upon the boiler which it cannot bear, on account of improper setting; while it might be able to withstand a much higher steam pressure without leaking, as, in this case, the weight on the supports of the boiler would not be altered.

E. B. T. says: After using a very powerful punching machine, on removing the sliding head, which had got dry, the fine cuttings dropped out and immediately took fire, or exploded like powder. The material was cast iron. Can you explain this? Answer: Substances containing carbon, when reduced to a certain fineness, and the particles (brought to a certain temperature, arranged in a certain way in respect to each other) have been known to absorb oxygen from the air so rapidly as to take fire spontaneously. Yours is evidently a case of this kind. We remember no example precisely similar.

M. says: I would advise J. N. H., who asked as to the comparative merits of a turbine and an overshot wheel, to put in the best turbine water wheel that he can buy; the advantages of a turbine over an overshot are many, some of which are that there is no trouble with back water and no trouble with ice. A scientifically constructed turbine will not vary materially (in the amount of work that it will do) from the overshot, and some well informed millwrights give a turbine the preference in quantity of work with same amount of water.

MINERALS.—Specimens have been received from the following correspondents, and examined with the results stated:

J. H.—It is calx spar or crystallized carbonate of lime. The effervescence with acid is due to the carbonic acid in it. It contains no iron or sulphur. Commercial acids frequently contain iron, and prussiate of potash is partially decomposed by strong sulphuric acid, so as to give a blue color when no iron is present. Test your acids before testing your minerals. The brown specimens are limestone containing some alumina, which gives them the characteristic odor of clay when breathed on.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Coöperation. By J. P. M.

On Chickens and Eggs. By H. E. H.

On a Fossil Corn Shuck. By J. H. F.

On the Million Dollar Telescope. By W. W. B.

On the Navigation of the Yarra. By J. M.

On a Celestial Phenomenon. By A. S. T.

On Flying Machines. By W. M. K.

On Railroads and Life Assurance. By J.

On Attraction and Repulsion. By I. F. T.

On an Auroral Phenomenon. By G. M.

On the Zodiacal Light. By T. R. L.

On an Auroral Display. By H. P. C.

On Steam Power on Canals. By W. J. B.

On the Newtonian Theory. By J. T. W.

Also enquiries from the following:

J. T. B.—V.—M. B. O.—J. M. E.—P. E.—G. R. E. G.—W. A. B.—F. J. S.—H. E. F.—W. H. M.—C. A.—C. P.—J. M. G.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

June 17, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Shirt, G. C. Thomas	139,933
Shirt, J. Wieser	139,937
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25,508.—TAILOR'S SHEARS.—R. Heinisch. September 3.

25,512.—BUNG HOLE BORER, ETC.—J. Kirby. September 3.

25,662.—CONSTRUCTION OF PRISONS.—E. May. Sept. 17.

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26,415.—WINDING THREAD ON SPOOLS.—H. Conant.

DESIGNS PATENTED.

6,703.—LATH BED.—W. F. Burton, Chippewa Falls, Wis.

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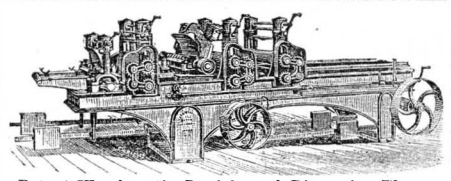

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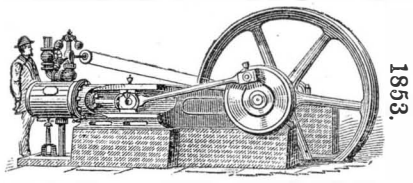

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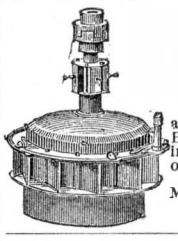

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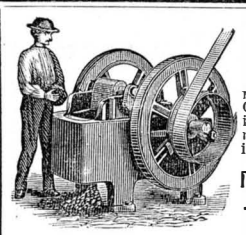

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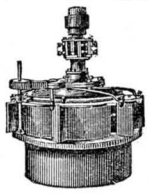

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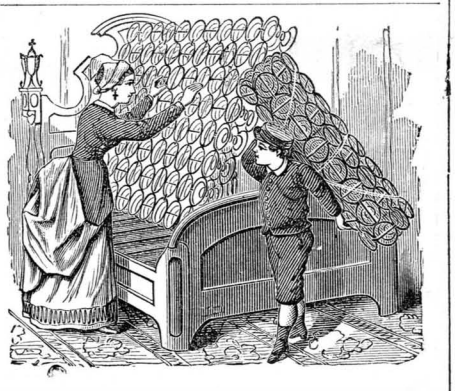

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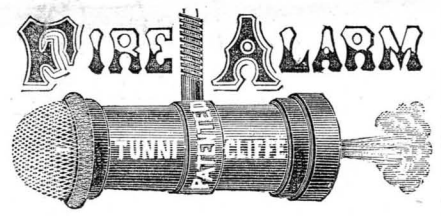

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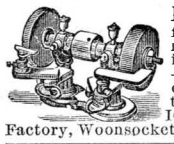

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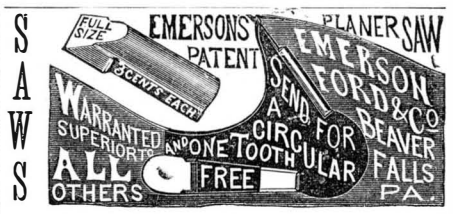

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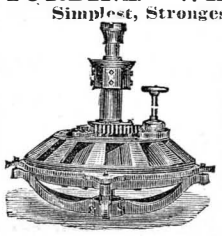

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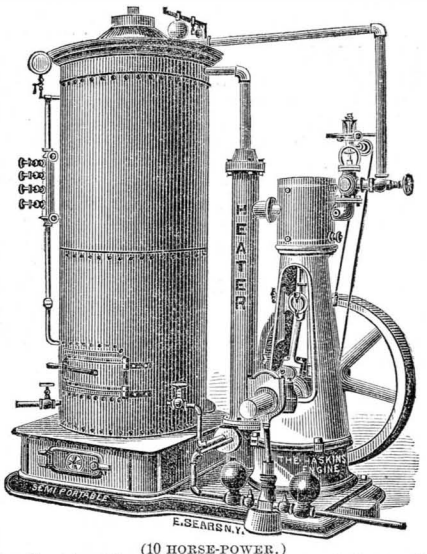

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